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West Fork of Swift Creek

Timber Sale Project

Draft Environmental Impact Statement

October 2004

NOV 2004

Department of Natural Resources and Conservation

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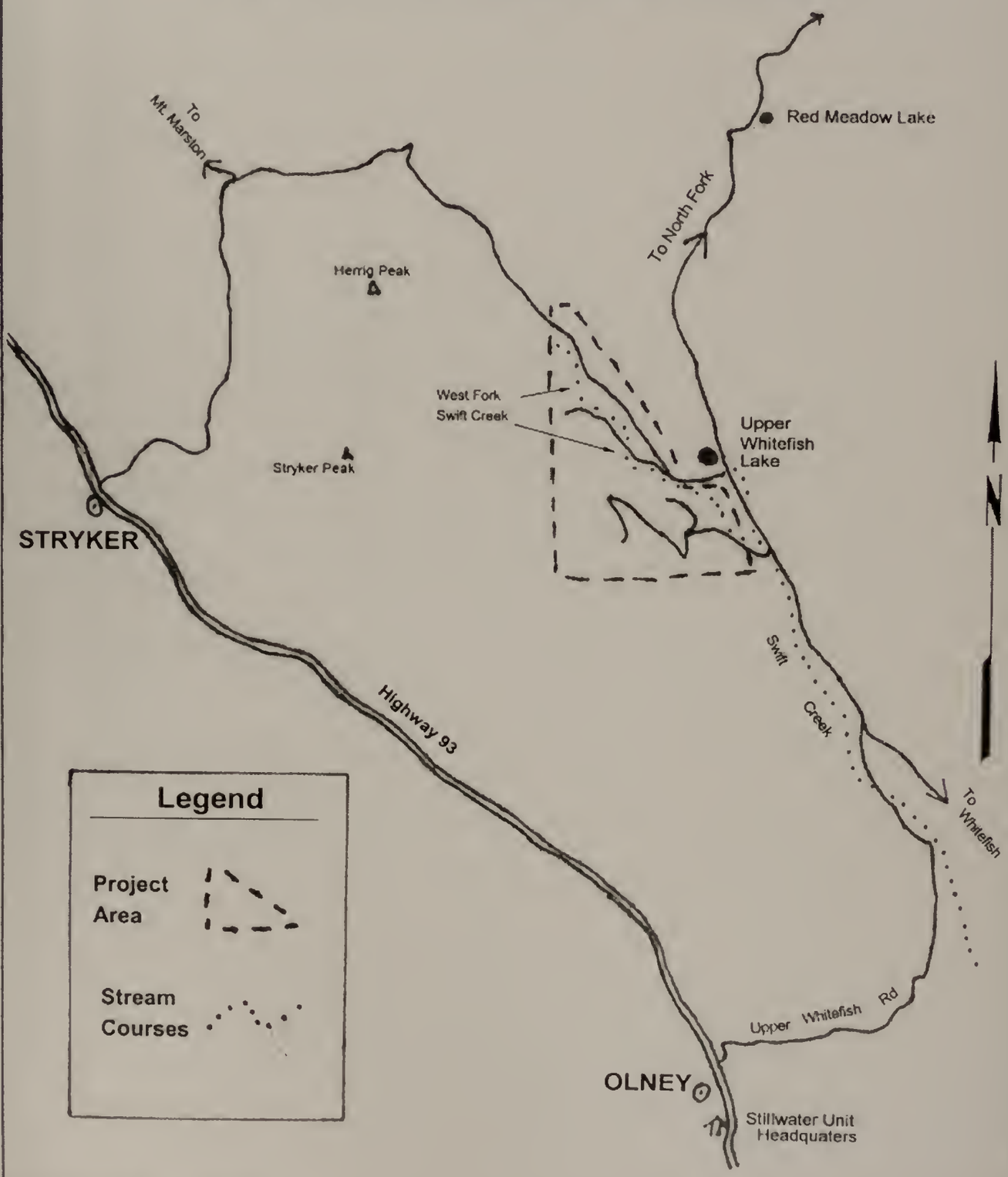
Vicinity Map for the West Fork Timber Sale Proposal



DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
PREFACE

The Department of Natural Resources and Conservation (DNRC) hopes to present a document that all interested parties could, regardless of their knowledge level, read and be able to fully comprehend the project and its analysis.

We must also have a document that is scientifically and legally sound. In the past, our experience has been that it is extremely difficult to produce a document that is easy to understand by all interested people and still withstand the appropriate scientific or legal review.

The Executive Summary of the DEIS is designed to encompass the Montana Environmental Protection Act (MEPA) rules. This information is written so that, with the supporting photographs and maps, it is easily understood.

The body of the DEIS was redesigned to combine Chapters III and IV into a single chapter, Chapter III. The analyses and conclusions that were completed by the ID Team are summarized in plain language, thus ensuring that all interested parties, regardless of their scientific or technical abilities, are able to understand this proposal and its effects.

The Interdisciplinary Team (ID Team) members prepared the resource appendices; the discussions include citations from other sources such as research documents, environmental assessments, etc. The lengthy discussions of methodologies, research, monitoring, baseline studies, analyses, etc., have been completed by the ID Team and are presented in the appendices. Because the analysis work required highly advanced technical procedures and terminology, that information is presented in the appendices. The information in the appendices would need to be utilized for any scientific, technical, or legal review.

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CHAPTER I
PURPOSE AND NEED

DESCRIPTION OF PROPOSED ACTIONS

Stillwater Unit, Montana Department of Natural Resources and Conservation (DNRC), is proposing the West Fork of Swift Creek (West Fork) Timber Sale Project west of Upper Whitefish Lake on Stillwater State Forest. The project includes:

- harvesting timber,
- replacing 2 bridges,
- removing several deteriorating log and earthen stream crossings, and
- improving drainage on roads leading to the harvest areas.

If a harvest alternative were selected, 5 to 10 millions board feet (mmbf) of timber would be harvested from 948 to 1,278 acres. In addition, depending on the alternative, 1 or 2 wooden bridges, in the project area that cannot support heavy machinery or fire engines would be replaced. The wooden bridge on Stryker Basin Road would be replaced with a 75-foot steel bridge; a 30-foot wooden bridge on North Johnson Road would be replaced with a temporary 30-foot steel bridge. Also, several older stream crossings in Stryker basin, originally constructed with logs and covered with dirt, are collapsing. This proposal would remove the collapsing structures and stabilize the streambanks.

The project area for the timber sale is located approximately 20 air miles northwest of Whitefish, Montana in Sections 18, 19, 20, 28, 29, 30, 31, 32, and 33, Township 34 north (T34N), Range 23 west (R23W) and Section 13, T34N, and R24W. The collapsing stream crossings are located in Section 25, T34N, R24W (*VICINITY MAP*, back of front cover).

PURPOSE OF PROPOSED ACTION

The primary objectives of this harvest are to generate income for the school trust, regenerate new stands of trees, and improve the growth of trees remaining in the harvest areas.

The lands involved in the proposed project are held by the State of Montana for the support of specific beneficiary institutions, such as public schools, State colleges and universities, and other specific State institutions, such as the school for the deaf and blind (*Enabling Act of February 22 1889: 1972 Montana Constitution Article X, Section 11*). The Board of Land Commissioners (Land Board) and DNRC are required by law to administer these trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions, *Section 77-1-2-2, Montana Codes Annotated* (MCA).

On May 30, 1996, DNRC released the Record of Decision on the State Forest Land Management Plan (SFLMP). The Land Board approved the SFLMP's implementation on June 17, 1996. On March 13, 2003, the Department adopted Administrative Rules for Forest Management (SFLM Rules) (*Administrative Rules of Montana [ARM] 36.11.401* through *450*). The SFLMP outlines the management philosophy and the proposal will be implemented according to the Rules. The philosophy is:

Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biological diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream… In the foreseeable future,

timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives.

PROPOSED OBJECTIVES

In order to meet the goals of the management philosophy adopted through a programmatic review of the SFLMP and the Rules, DNRC has set the following specific project objectives:

- Harvest 4 to 10 mmbf of sawtimber to generate revenue for the appropriate school trusts. The sale would also provide a sufficient amount of sawlog volume to contribute to the sustained yield for DNRC, as mandated by *State Statute 77-5-222, MCA.*
- Improve the long-term productivity of timber stands by increasing stand vigor, reducing incidence of insect infestations and disease infections, and regenerating portions of stands where timber-stand growth is decreasing. Actions would be done in a manner that maintains site productivity and favors the retention and regeneration of appropriate tree species (desired future conditions [*ARM 36.11.405*]).
- Replace the bridge across the West Fork in Section 29, T34N, R23W.
- Provide for additional benefits and maintain options for sustained revenue to the school trusts by completing site improvements on existing roads to improve drainage, water quality, and safety as recommended by current Best Management Practice Standards (BMPs) for Forestry.
- Implement SFLM Rules.

ENVIRONMENTAL IMPACT STATEMENT PROCESS

EIS DEVELOPMENT

This EIS was prepared in compliance with the Montana Environmental Policy Act (MEPA), which requires State government to include the consideration of environmental impacts in its decisionmaking process. Agencies are also required to inform the public and other interested parties about proposed projects, environmental impacts that may result, and alternative actions that could achieve the project objectives.

PUBLIC SCOPING

Public scoping occurs in the initial stage of an EIS and is used to inform the public that a State agency is proposing an action. The public has the opportunity to express their comments or concerns about the possible impacts of the project.

In April 2001, DNRC solicited public participation in the West Fork Timber Sale Project Proposal by placing notices in the Whitefish Pilot and Kalispell's Daily Interlake newspapers; an article announcing the scoping of the project was also published in the Daily Interlake. In addition, a letter that included maps and general information about the project and the project area was mailed to individuals, agencies, industry representatives, and other organizations that had expressed interest in Stillwater State Forest's management activities. The mailing list developed for this project is located in the project file.

The public-comment period for the initial project proposal was open for 30 days. As a result of the letters and notices in the newspapers, a total of 10 letters and phone calls were received. The issues and concerns identified through the public scoping were

summarized and used to further refine the project.

The Interdisciplinary Team (ID Team), made up of DNRC's wildlife biologist, hydrologist, and several foresters, began compiling the issues and gathering information related to current conditions in May of 2001.

The priorities of the Stillwater Unit timber-sale program shifted from this timber sale to fire salvage during the remainder of 2001 and most of 2002 and 2003. In February 2002, a letter updating this project was sent to those on the mailing list; no responses were received. Another update letter was sent to the groups and individuals on the mailing list in February of 2004. This letter further described the status of the alternative-development process and provided notice that the SFLM Rules (*ARM 36.11.401* through *450*) would be followed on the project.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

This DEIS displays how several proposed actions were developed, defines the proposals (alternatives), explains how public and Agency comments and issues have been incorporated into the project, and describes related impacts to various resources. Either this DEIS and its Executive Summary or a notification that the DEIS is available will be mailed to groups or individuals as requested. The DEIS will also be published on the web at www.dnrc.mt.us. Comments on the DEIS will be accepted by Stillwater Unit for 30 days.

FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS)

After public comments on the DEIS are received, compiled, and addressed, DNRC will prepare an FEIS or adopt the DEIS as the FEIS. The FEIS consists, primarily, of a revision of the DEIS that incorporates new information based on public and internal comments.

NOTIFICATION OF DECISION

Following publication of the FEIS, the Stillwater State Forest Unit Manager will review public comments, the FEIS, and information contained in the project file. No sooner than 15 days after publication of the FEIS, the Unit Manager will consider and determine the following:

- Do the alternatives presented in the FEIS meet the project's purpose?
- Is the proposed mitigation adequate and feasible?
- Which alternative or combination/modification of alternatives should be implemented and why?

These determinations will be published and all interested parties will be notified. The decisions presented in the published document would become recommendations by DNRC to the Land Board. Ultimately, the Land Board would make the final decisions regarding which actions to implement.

SCOPE OF THIS ENVIRONMENTAL ANALYSIS

OTHER ENVIRONMENTAL REVIEWS RELATED TO THE PROJECT

In order to address direct, indirect, and cumulative effects on many resources, the analysis must incorporate past, present, and future actions within a determined analysis area. The locations and sizes of the analysis areas vary by resource (watershed, soils, etc.) and species (grizzly bear, Canada lynx, etc.) and are further described by resource in Chapter III and the various resource appendices. The following timber sales are located within several of the West Fork environmental analysis areas.

- Ongoing timber sales where the environmental analysis has been completed:

- Chicken/Werner Timber Sale Project EIS (1999)
- Taylor South Timber Sale Project EIS (2001)
- Good/Long/Boyle Timber Sale Project Environmental Analysis (EA) (2000)
- Dog/Meadow Timber Sale Project EA (2003)
- Ewing Middle Ridge EA (2004)

- The Point of Rocks Timber Sale Project was scoped in May/June of 2004 and the environmental review is now in progress.
- The Ewing/Fish Lake and Old Highway timber sale projects have been identified on DNRC's 3-year timber sale list as the next potential projects for Stillwater Unit. Currently, no proposal/proposed action has been initiated and the potential projects have not been scoped; therefore, DNRC has not initiated a preimpact study on these proposals.

OTHER AGENCIES OR ENTITIES WITH JURISDICTION RELATED TO THIS PROJECT

Montana Department of Fish, Wildlife and Parks (DFWP)

DFWP has jurisdiction over the management of fisheries and wildlife in the project area. A Stream Preservations Act Permit (124 Permit) is required from DFWP for activities that may affect the natural shape and form of any stream or its banks or tributaries.

Montana Department of Environmental Quality (DEQ)

A Short-term Exemption from Montana's Surface Water Quality Standards (3A Authorization) may be required by DEQ if:

- temporary activities would introduce sediment above natural levels into streams, or
- DFWP feels a permit is necessary after reviewing the mitigation in the 124 Permit.

Montana Airshed Group

DNRC is a member of the Montana Airshed Group, which regulates slash burning done by DNRC. DNRC receives air-quality permits through participation in the Montana Airshed Group.

Plum Creek Timber Company

Cooperative road-maintenance activities by DNRC and Plum Creek Timber Company occur on "cost-share" roads to reduce sediment delivery from roads.

ISSUES AND CONCERNS

Through the scoping process, resource specialists of DNRC and other agencies and the public raised concerns about the project's potential impacts on the environment. These concerns were considered by DNRC in the development of project alternatives (see *CHAPTER II*). A summary of the comments that were incorporated in the alternatives is presented by resource in *TABLE I-1 - SUMMARY AND TRACKING OF ISSUES AND CONCERNS FROM PUBLIC COMMENTS*.

TABLE I-1 - SUMMARY AND TRACKING OF ISSUES AND CONCERNS FROM PUBLIC COMMENTS

RESOURCE AREA	CONCERN OR ISSUE	WHERE ADDRESSED IN EIS PACKAGE
Vegetation	The timber sale design should promote a healthy and vigorous forest, reduce the risks of wildfires, and improve the species composition to levels and types that were historically present.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX B - VEGETATION ANALYSIS*
	This timber harvest, in conjunction with other past timber sales, may have an affect on the anticipated historic conditions of the landscape.	
Water Quality and Water Yield	Proposed activities, such as road construction and timber harvesting, could negatively affect several watersheds tributary to Whitefish Lake. Increased waterflows into streams, which could also affect the water quality of the lake, may occur as a result of these activities.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX D - WATERSHED AND HYDROLOGY ANALYSIS*
	The West Fork of Swift Creek is listed as a water-quality-limited stream; a Total Maximum Daily Load (TMDL) calculation has not been prepared for this stream.	
Soils	Timber harvesting can affect long-term soil productivity by removing biomass, and, therefore, nutrients from the harvest areas.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX H - SOILS ANALYSIS*
	Long-term soil productivity can be affected by soil compaction and displacement.	
Fisheries	This project may further degrade fisheries habitat.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX E - FISHERIES ANALYSIS*
Wildlife	Logging activity and roads can cause loss or fragmentation of habitat, affect the quality of habitat, displace species with special habitat needs, and cause increases in open-road densities.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX F - WILDLIFE ANALYSIS*
Economics	If an action alternative of this project is implemented, direct costs and impacts to the local economy and selected socioeconomic institutions would occur.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX G - ECONOMICS ANALYSIS*
	Some individuals feel that tourism and recreation have economic value in the area.	
	Timber stand access, road improvements, and harvest methods can have an impact on the project's feasibility.	
Road Management	Changes to public access on Stillwater State Forest as a result of this project is a concern.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES*

CHAPTER II
ALTERNATIVES

INTRODUCTION

The purpose of Chapter II is to introduce 2 action alternatives for the West Fork of Swift Creek Timber Sale Project area and summarize the effects of each action alternative and the no-action alternative. This chapter will focus on the development of the action alternatives, summarize the description of each alternative, and briefly outline the probable environmental consequences associated with each alternative. *TABLE II-2- SUMMARY OF ENVIRONMENTAL EFFECTS* summarizes the detailed environmental effects analysis in *CHAPTER III - EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* or the various resource appendices.

DEVELOPMENT OF ALTERNATIVES

An ID Team was formed in the spring of 2001 to work on the West Fork Timber Sale Project. The role of an ID Team is to summarize issues and concerns, develop management options within the project area, and analyze the potential impacts of a proposal on the human and natural environments.

DNRC began reviewing resources in this area prior to 2000. Data was collected for resources within the project area to aid in the analyses of wildlife habitat, hydrology, fisheries, old-growth timber stands, timber-harvest feasibility, transportation systems, and economics. This was also used to develop mitigation that could be applied to the proposal.

Foresters provided the ID Team with a harvest and road proposal to accomplish and meet the desired future forest conditions on Stillwater Unit and the objectives described in *CHAPTER I - PURPOSE AND NEED*. The proposal addresses some areas that were harvested around 1950 and currently have stand conditions that would likely not occur under natural processes (Harvest Area II). Another area, Harvest Area III, provides an opportunity to regenerate new stands of timber similar to the results of a wildfire. The ID Team further developed the proposal within the framework of the SFLMP and its administrative rules. The ID Team discussed how to address both public and internal issues, mitigations required by the SFLM Rules, and additional mitigations that may be implemented to reduce or minimize effects related to the project. This proposal developed into Action Alternative B.

During the initial evaluation of Action Alternative B, issues related to the harvesting activities in Harvest Area III, which do not occur when harvesting in Harvest Areas I and II, were noted by the ID Team. Harvest Area III includes harvesting in stands of old-growth timber; and the costs of logging, road development, and site preparation are also higher in Harvest Area III than costs associated with Harvest Areas I and II. Issues with open-road-density levels are also more complex when entering the locations in Harvest Area III. The open-road-density levels can be met in the Upper Whitefish Lake Grizzly Bear Management Subunit, although existing open roads would be restricted while implementing the project.

Harvest Areas I and II would not include old-growth timber stands, but would require mitigation to meet the open-road-density level. Those mitigation measures are in the form of road restrictions within the West Fork Timber Sale Project area. Logging costs are minimized with the

use of common skyline and ground-based logging equipment.

Based on discussions and reviews of the issues, the decisionmaker was comfortable with developing a second action alternative, Action Alternative C, which would harvest those areas in Harvest Areas I and II, but not the areas in Harvest Area III.

The decisionmaker also asked the ID Team to meet 2 additional objectives: replace the bridge on the West Fork and complete site improvements on existing roads to improve water quality. These objectives are listed in Chapter I.

To relieve economic concerns related to the removal of a wooden bridge and installation of a 75-foot steel bridge across the West Fork, Harvest Area II-P was added to both action alternatives. Expected returns from the harvest of Area II-P would cover the expenses of the bridge work. This bridge is instrumental in accessing the Stryker Basin area for fire protection, timber management, and recreation.

Inventory and assessment work was completed on existing roads within the project area in 2004. This information has identified sections of roads that should be improved to meet BMP standards prior to hauling logs. This information also helped identify several older stream crossings as potential sediment sources to the West Fork. These crossings in Section 25, T34N, R24W, and Section 29, T34N, R23W, were originally constructed with logs and covered with dirt and are beginning to collapse. Both action alternatives include upgrading roads to meet BMPs, removing the collapsing structures, and stabilizing the streambanks.

Rotting West Fork wooden bridge that would be replaced with a 75-foot steel bridge.

Collapsed native culvert that would be removed under either action alternative.

ALTERNATIVE DESCRIPTIONS

This section describes No-Action Alternative A and the developed Action Alternatives B and C.

- ***Description of No-Action Alternative A***

  No large-scale timber harvesting or roadwork would take place, although salvage logging and firewood gathering would likely continue. Road reconstruction beyond coordinated maintenance agreements would not be conducted. The bridge over the West Fork, currently restricted to 5 tons or less, would not be replaced at this time.

  Current road restrictions would remain the same. Recreational uses, such as hunting, fishing, berry picking, and snowmobiling, are expected to continue.

  Fire-suppression and weed-control efforts would continue.

  Natural events, including plant or forest succession, windthrow, insect and disease outbreaks, and wildfires, would continue to occur. Future actions, including timber harvesting, would be proposed and undergo environmental analysis before implementation.

  No-Action Alternative A, which can be used as a baseline for comparing the environmental consequences of Action Alternatives B and C, is considered a viable alternative for selection.

- ***Description of Action Alternative B***

  Under this alternative, approximately 9.5 mmbf would be harvested from an estimated 1,270 acres. A description of the three harvest and silvicultural prescriptions proposed under this alternative will be explained under *Timber-Management Activities*. A more detailed description of silvicultural prescriptions, photographs, and *TABLE II-1 - SILVICULTURAL TREATMENTS BY HARVEST AREA NUMBER FOR ACTION ALTERNATIVES B AND C* will be presented under *PROPOSED SILVICULTURAL TREATMENTS*. A description of the proposed road plan and road-management options proposed to implement this alternative are provided under *Road Plans and Management Activities*. (Refer to *WEST FORK TIMBER SALE ALTERNATIVE B* map.)

  - **Timber-Management Activities**

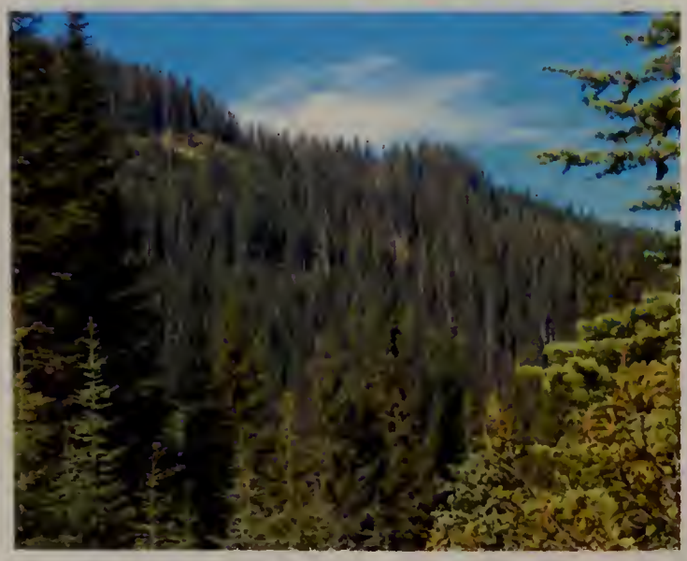
    Within Harvest Area I, approximately 72 acres would be commercially thinned by utilizing a skyline cable system to harvest approximately 50 to 70 percent of the trees. A stand stocked with primarily Douglas-fir and western larch trees over 7 inches diameter at breast height (dbh) would remain.

Landscape view of proposed Harvest Area I. Approximately 72 acres would be commercially thinned.

    Within Harvest Areas II-A, II-C, II-G, II-H, and II-P, harvests of group selection and overstory removal are proposed on 866 acres. Due to timber-harvest treatments in the 1950s and the mosaic of age classes and tree sizes left in these areas, the amount of trees actually harvested per acre would vary from none to small clearcuts. Although the majority of the

area can be harvested with ground-based systems, skyline cable systems are necessary in some locations. Associated with the logging, a dozer or excavator would pile logging slash and prepare sites for the planting of western larch and western white pine seedlings.

A mid-ground view of Harvest Area II, where group-selection and overstory-removal harvest treatments would be done on approximately 866 acres.



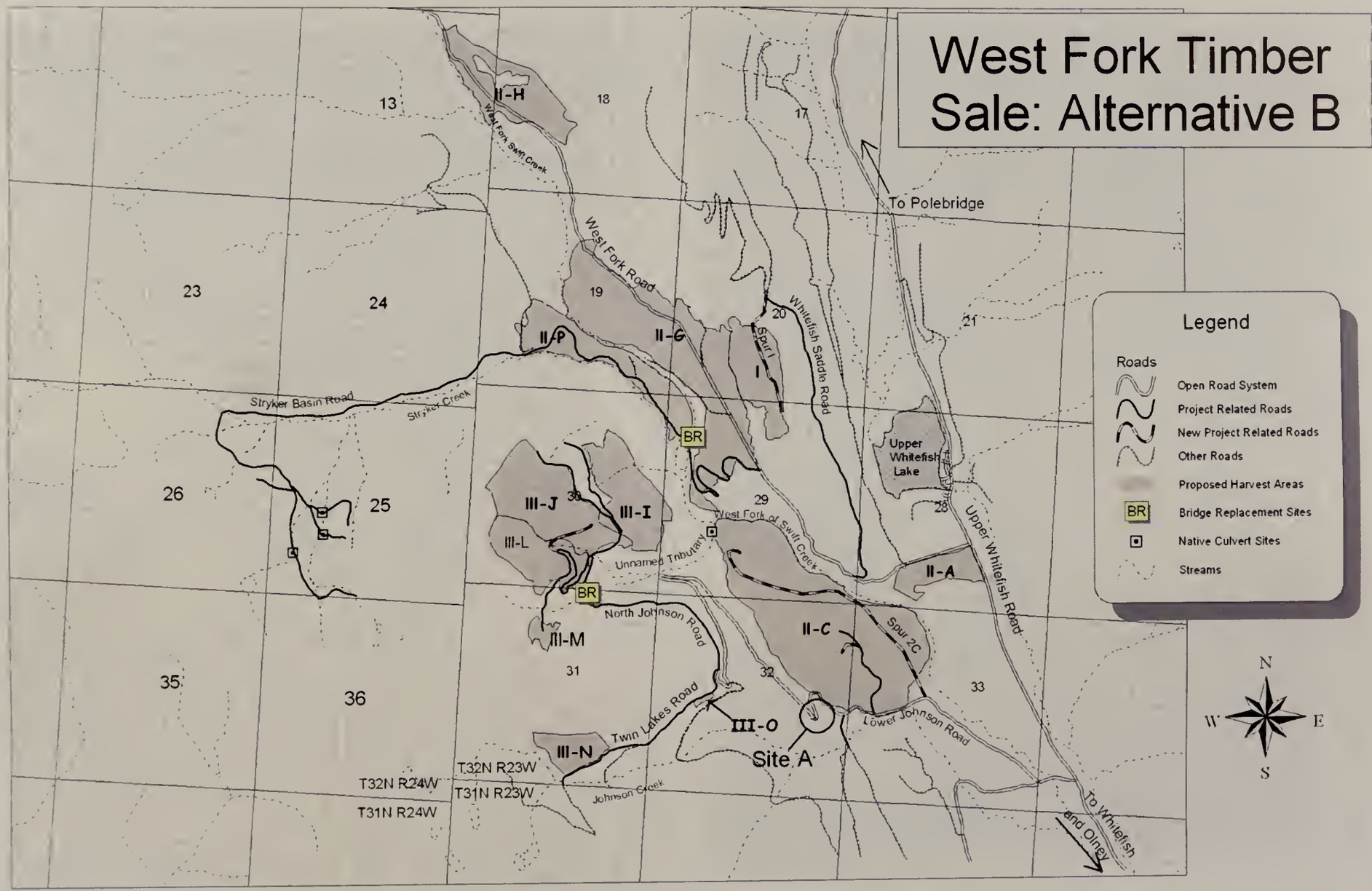
Closer view of Harvest Area III

Within Harvest Areas III-I, III-J, III-L, III-M, III-N, and III-O, regeneration harvests are proposed on 308 acres, utilizing a combination of ground-based and skyline-cable systems. Groups of trees, ranging from a few trees to several acres, would be left standing in the harvest areas following

Landscape view of Harvest Area III. Regeneration harvests are proposed on approximately 308 acres, utilizing a combination of ground-based and skyline-cable logging systems.

A foreground view of Harvest Area III

FIGURE II-1


West Fork Timber Sale: Alternative B
Legend
Roads
Open Road System
Project Related Roads
New Project Related Roads
Other Roads
Proposed Harvest Areas
Bridge Replacement Sites
Native Culvert Sites
Streams
To Polebridge
To Whitefish and Olney
West Fork Road
Whitefish Saddle Road
Upper Whitefish Road
Lower Johnson Road
North Johnson Road
Twin Lakes Road
Stryker Basin Road
Stryker Creek
West Fork Swift Creek
Unnamed Tributary
Johnson Creek
Spur 1
Spur 2C
Upper Whitefish Lake
Site A
BR
II-H
II-P
II-G
I
II-A
II-C
III-J
III-I
III-L
III-M
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III-O
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harvesting. To reduce logging slash and prepare the area for new trees to regenerate, approximately 216 acres in Harvest Areas III-I and III-J are planned for broadcast burning, dependent upon such factors as funding, weather, site conditions, and personnel availability. Excavator site preparation and slash disposal would be conducted on the remaining acres. If burning could not be done, an excavator would pile slash and scarify the ground in Harvest Area III. A mixture of tree species would be planted in these areas.

- **Roadwork Activities**

Approximately 31.0 miles of existing roads accessing the harvest areas would require various levels of heavy maintenance; some minor reconstruction, including road widening and culvert installations, would be necessary to meet safe travel requirements and BMPs.

Approximately 1.0 mile of new road would be necessary to access Harvest Area I; approximately 2.1 miles of brushed-in roads and new road would be needed to access Harvest Area II-C and approximately 0.3 miles of new road would be required for access to Harvest Area III-J. All these road segments would be restricted to administrative and logging purposes only. Following logging and site preparation operations, slash, root wads, and grass seed would be distributed on the road to stabilize the roadbed and prevent motorized vehicle use.

This proposal would replace 2 bridges. The bridge on Stryker Basin Road would be replaced with a 75-foot steel bridge, and a 30-foot wooden bridge on North Johnson Road would be replaced with a 30-foot temporary steel bridge.

Three older stream crossings in Section 25, T34N, R24W, and one crossing in Section 29, T34N, R23W, originally constructed with logs and covered with dirt, are in the early stages of collapse. One wooden bridge has failed and fallen into the unnamed tributary in Section 30, T34N, R23W. This alternatives proposes to remove 5 structures and stabilize the streambanks to eliminate potential sediment sources in the future and upgrade roads to meet BMPs.

This broken native bridge is located on an unnamed tributary in Section 30. This bridge would be removed and the banks would be stabilized to prevent erosion of dirt into the stream.

This road slump would be repaired to meet Best Management Practices (BMPs) before log hauling takes place.

- ***Description of Action Alternative C***

Under this action alternative, approximately 5.7 mmbf would be harvested from an estimated 938 acres. A description of the 2 harvest and silvicultural prescriptions proposed under this alternative will be explained under *Timber-Management Activities*. A more detailed description of silvicultural prescriptions, photographs, and *TABLE II-1 - SILVICULTURAL TREATMENTS BY HARVEST AREA NUMBER FOR ACTION ALTERNATIVES B AND C* will be presented under *PROPOSED SILVICULTURAL TREATMENTS*. *Road Plans and Management Activities* describes the proposed road plan and road-management options needed to implement this alternative. (Refer to *WEST FORK TIMBER SALE ALTERNATIVE C* map.)

➢ **Timber-Management Activities**

This action alternative proposes timber-management activities only within Harvest Areas I and II; the prescriptions are the same as those described under Action Alternative B. No timber-management activities would occur in Harvest Area III. (Refer to *WEST FORK TIMBER SALE: ALTERNATIVE C* map and *TABLE II-1 - SILVICULTURAL TREATMENTS BY HARVEST AREA NUMBER FOR ACTION ALTERANTIVES B AND C*.)

➢ **Roadwork Activities**

On the road systems accessing the harvest areas, approximately 24.5 miles of existing road would require various levels of heavy maintenance. Some minor reconstruction, including road widening and culvert installations, would be required to meet safe travel requirements and BMPs.

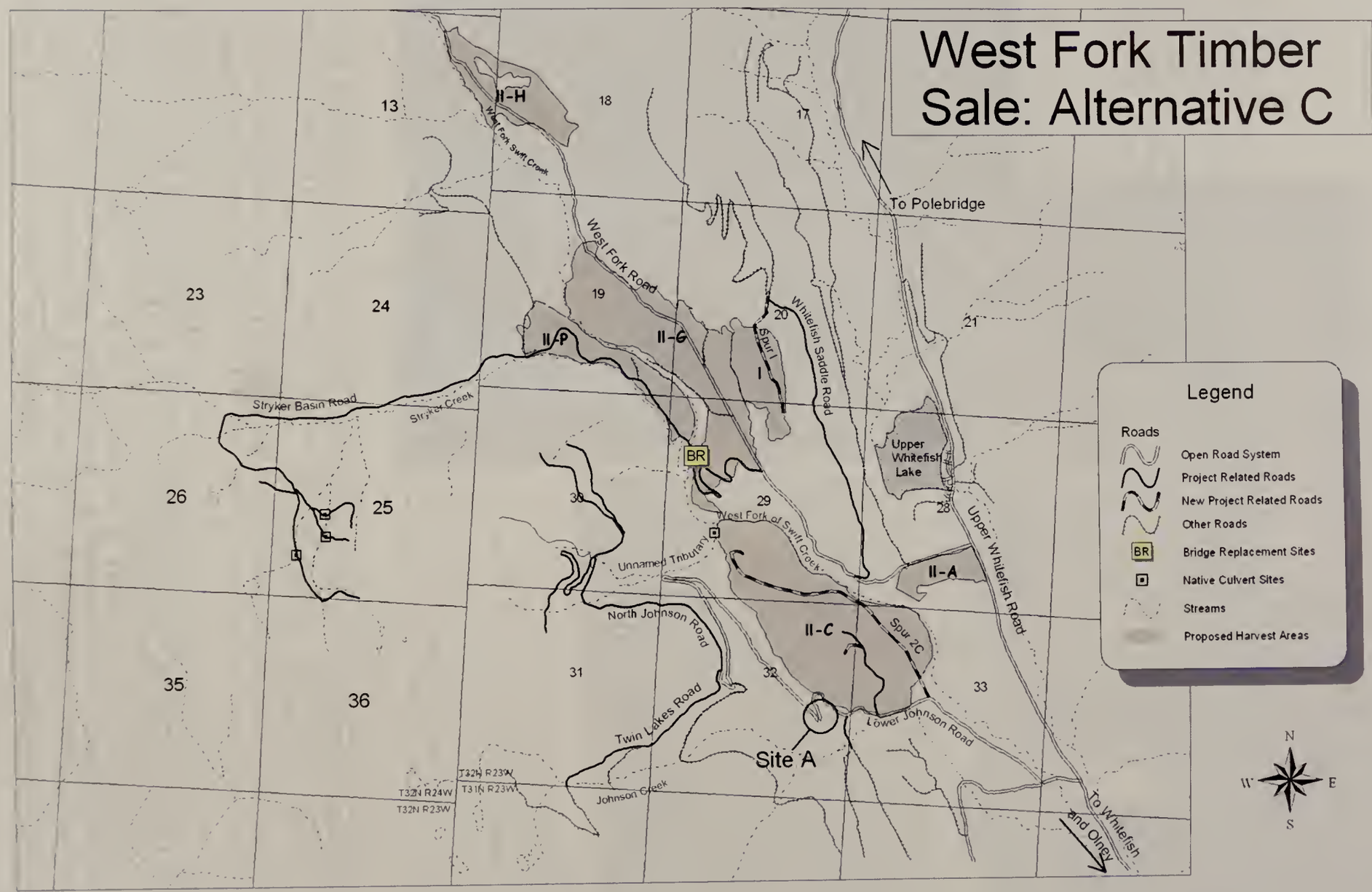
Approximately 1.0 mile of new road would be necessary to access Harvest Area I; approximately 2.1 miles of brushed-in roads and new road would be needed to access Harvest Area II-C. Both of these road segments would be restricted to administrative and logging purposes only. Following tree-planting operations, slash, root wads, and grass seed would be distributed on the road to stabilize the roadbed and prevent motorized vehicle use.

New road would be built to access some harvest areas. At the completion of tree-planting activities, slash, root wads, and grass seed would be placed on the road to stabilize the roadbed and prevent motorized vehicle use.

Action Alternative C proposes to replace the wooden bridge on Stryker Basin Road with a 75-foot steel bridge. This is the only bridge replacement under this alternative proposal.

Three older stream crossings in Section 25, T34N, R24W, and one crossing in Section 29, T34N, R23W, originally constructed with logs and covered with dirt, are in the early stages of collapse. This alternative proposes to remove 4 structures and stabilize the streambanks to eliminate potential sediment sources in the future and upgrade roads to meet BMPs.

FIGURE II-2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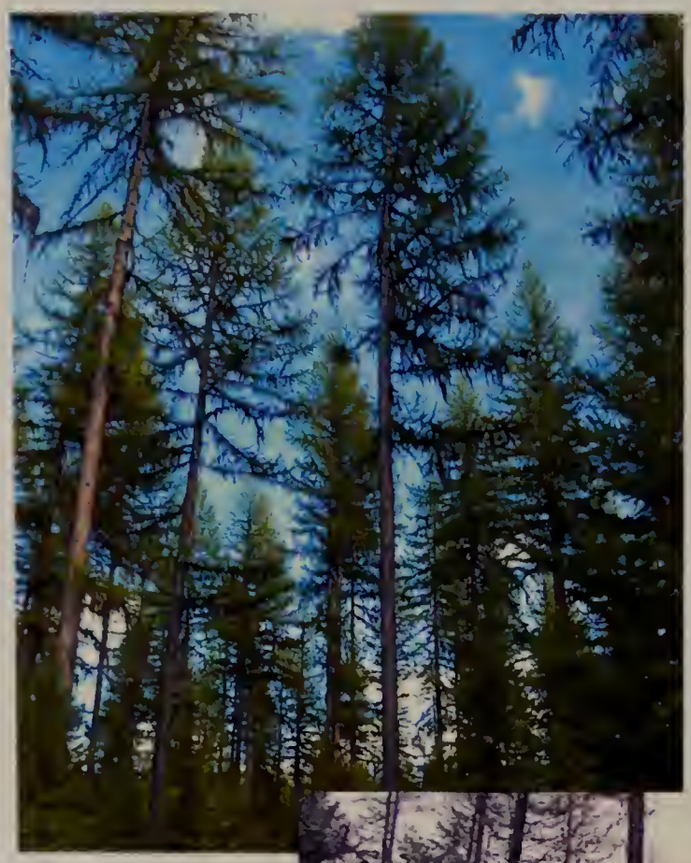
Whitefish Saddle Road
Upper Whitefish Road
Lower Johnson Road
North Johnson Road
Twin Lakes Road
Stryker Basin Road
Stryker Creek
West Fork Swift Creek
West Fork of Swift Creek
Unnamed Tributary
Johnson Creek
Upper Whitefish Lake
Spur 1
Spur 2C
II-H
II-P
II-G
I
II-A
II-C
Site A
BR
13
18
17
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
T32N R24W
T32N R23W
T31N R23W
N
S
E
W

PROPOSED SILVICULTURAL TREATMENTS

Three different silvicultural prescriptions (harvest treatments) were chosen for this project to meet the management objectives. The photographs provide a visual representation of how these treated areas may appear following harvesting activities. Due to the variations in stand age, species components, and natural openings, the visualizations show what would be expected to occur on the ground.

- ***COMMERCIAL-THIN HARVEST***

  Fifty to seventy percent of the existing overstory would be harvested to reduce the stocking density, improve growth rates and vigor, and increase the representation of western larch in the stand. The stand would be fully stocked with trees, but have an open-canopy appearance following harvesting.



Notice the open-canopied stand that has resulted from a commercial-thin harvest treatment.

Removal of 50 to 70 percent of the overstory reduces the stocking density, allowing tree growth rates and vigor to improve.

- *GROUP-SELECTION/OVERSTORY-REMOVAL HARVEST*

Due to the multistoried structure of the existing stands, this type of harvest treatment would result in several different stand conditions:

- Small openings, up to 5 acres in size, would be created in the existing stand to promote new regeneration. Within these sites, most of the merchantable trees would be harvested, the excess logging slash piled, the ground scarified, and western larch and western white pine planted.
- Trees that were too small for harvesting during the 1950s, and now overtop the sapling- and pole-sized trees, would be harvested to:
  * reduce value loss and mortality,
  * Reduce the stocking density, and
  * increase the growth of the smaller diameter trees by allowing more sunlight and moisture.
- An estimated 90 percent of the proposed harvest areas would receive some level of harvest treatment. Harvesting would not go through places that are currently without merchantable trees.
- Existing snags and an average of 1 tree of large diameter per acre would be retained individually or in groups throughout the harvest area. Most western larch would be retained.

A landscape view of proposed Harvest Area II, where a combination of group-select and overstory removal harvests would be implemented.

In this 23-acre group-select/ overstory-removal harvest unit, the 3-acre area in the picture has been prepared to grow new trees.

An overstory-removal harvest would remove most merchantable trees and leave sapling-sized trees room to grow.

- ***REGENERATION HARVEST***

  Most trees would be harvested, the excess logging slash piled or burned, and the site planted with a mix of tree species, including western larch, Douglas-fir, lodgepole pine, and whitebark pine. Areas near streams, inaccessible to logging systems, or designated by the Department, would not be harvested; these are group-retention areas. Existing snags and an average of 1 large-diameter tree per acre would be retained individually or in groups throughout the harvest area. Due to safety and the difference in the way logs are skidded to the landings, less snags would be left in areas harvested by skyline logging equipment than those areas harvested with ground-based logging equipment.

Excess slash on a regeneration harvest area would be piled and burned. A mixture of tree species (such as western larch, Douglas-fir, lodgepole pine, and whitebark pine) would be planted in the harvest area. This is an example of Harvest Area III posttreatment.

TABLE II-1 - SILVICULTURAL TREATMENTS BY HARVEST AREA NUMBER FOR ACTION ALTERNATIVES B AND C

ACTION ALTERNATIVE	HARVEST AREA		ACRES	VOLUME	HARVEST TREATMENT	SITE PREPARATION TREATMENT METHOD
B and C	I	Section 20	71.8	340	Commercial thin with skyline system	Site preparation is not required.
B and C	II-A	Section 28	39.3	190	Group select/ overstory removal with ground-based operations	Mechanical
B and C	II-C	Sections 29, 32, and 33	363.5	2,250	Group select/ overstory removal with ground-based operations	Mechanical
B and C	II-G	Sections 19, 20, and 29	271.9	1,750	Group select/ overstory removal with ground-based operations	Mechanical
B and C	II-H	Section 18	93.5	665	Group select/ overstory removal with ground-based operations	Mechanical
B and C	II-P	Sections 19, 20, 29, and 30	100.5	500	Group select/ overstory removal with ground-based operations	Mechanical
B	III-I	Section 30 (east)	91.9	1,255	Seedtree with skyline system utilized	Combination broadcast burn and mechanical
B	III-J	Section 30 (mid-section)	123.9	1,350	Regeneration with groups of trees retained and skyline systems utilized	Combination broadcast burn and mechanical
B	III-L	Section 30	72.4	880	Regeneration with groups of trees retained and skyline and ground-based skidding systems utilized	Mechanical
B	III-M	Section 31 (north)	9.3	110	Regeneration with groups of trees retained and ground-based skidding system utilized.	Mechanical
B	III-N	Section 31 (south)	33.0	185	Regeneration with groups of trees retained and ground-based skidding system utilized.	Mechanical
B	III-O	Section 32	1.8	35	Seedtree with skyline system	Site preparation is not required.

MITIGATIONS

To accomplish the various elements of the proposed project, certain methods or mitigation measures would be designed and applied. Mitigation measures are designed to reduce impacts and protect resources during harvesting and road-improvement activities. Many are written into the SFLM Rules, but are substantial enough to the design of the project to mention here again. Other mitigation measures pertinent to this project will be tracked in the *STIPULATIONS AND SPECIFICATIONS* section of the resource appendices. Many mitigation measures are designed to be incorporated into the Timber Sale Contract or site-preparation contract clauses and are implemented through contract administration.

This section describes the mitigations and design components common to both action alternatives and describes those specific to each alternative.

MITIGATIONS COMMON TO BOTH ACTION ALTERNATIVES BY RESOURCE

- Water Quality and Fisheries
  - While removing and installing the bridge on Stryker Basin Road, construction work near the West Fork would be limited to July 15 through August 20 to avoid disturbance during bull trout spawning.
  - Timber-harvesting activities would not occur within 100 feet of the West Fork and Stryker and Johnson creeks; this would address fisher rules and exceed rules for the Riparian Management and Streamside Management Zone (SMZ) Law.
  - A segment of Lower Johnson Road is near the banks of Johnson Creek; approximately 600 feet of road would be built farther from the creek and the original segment would be reclaimed with brush and grasses.
- Wildlife and Road Management
  - A gate would be installed at Site A (see project map) and remain closed for the entire year if road use to access Harvest Area 1 receives use exceeding 7 trips/week or 30 days of intensive use.
  - Log hauling from Harvest Area I on the Whitefish Saddle Road would be limited to August 15 through February 1 (eaglets have fledged by August 15).
  - The Whitefish Saddle, Stryker Basin, and Spur II-C roads would be restricted to administrative use and harvesting operations.
  - The earthen berm on Stryker Basin Road would be removed and replaced with a gate. Following harvesting, slash reduction, and site preparation, the earthen berms and waterbars would be replaced.
  - Gates would be installed on the roads needed to access Harvest Area II-C to restrict public motorized use. Following project completion, these roads would be reclaimed by seeding grass, distributing slash, and constructing water bars.
  - All timber-harvesting activities, including log hauling, from Harvest Area IIA, would be limited to August 15 through February 1 (after eaglets have fledged).

MITIGATION MEASURES TO BE APPLIED TO ACTION ALTERNATIVE B

- Harvesting activities within Harvest Areas I and III would not occur within the same year. If Area III is not active and the closure is moved to Site A, open-road-density levels can be met during the harvesting of Area I.
- The temporary bridge accessing most of Harvest Area III would remain in place during the site-preparation and regeneration

VEGETATION ANALYSIS

INTRODUCTION

This summary of *APPENDIX B - VEGETATION ANALYSIS* will provide a description of the present conditions of the forest. Also discussed are the effects the proposed alternatives would potentially have on the following issues:

- The distributions of covertypes and age classes at a landscape level (Stillwater State Forest and scattered sections north in Lincoln County).
- The distribution of old-growth timber at a landscape level and the characteristics (attributes) of the old-growth stands within the project area.
- The development of timber stands in the project area in relation to natural disturbances and timber management.

ANALYSIS METHODS

The current stand conditions will be compared to the stand conditions that DNRC believes to be the desired future conditions and appropriate for the site. A forest inventory from the 1930s was used to estimate the proportion of the various stages of stand structure by age classes and covertypes that were historically represented throughout the Inland Northwest (*Losensky 1993*). From this, estimations have been made of the natural characteristics of forests in the period prior to fire suppression and extensive logging.

The procedure used to assign covertypes on State forested lands, including Stillwater State Forest, is explained in detail in the SFLM Rules (*ARM 36.11.405*).

The methods to identify old-growth timber stands are initiated from modeling based on the STW 2003 Stand Level Inventory (SLI) data. The model primarily sorts for stands that meet the age criteria and number of trees greater than a particular dbh, based on habitat-type groups. Field surveys were used to verify additional stands in the project area that meet the definition.

The analysis method for stand development is a discussion of the conditions of timber stands and how natural and man-caused disturbances may continue to affect the development of timber stands.

ANALYSIS AREA

The vegetation analysis includes 3 geographic scales:

- Upper Flathead Valley - Historic conditions refer to those from Climatic Section 333C of the Upper Flathead Valley (*Losensky 1997*).
- Stillwater State Forest management block - Current and appropriate conditions for covertype, age, and old-growth distribution were analyzed. This analysis area is approximately 100,208 forested acres that includes the entire Stillwater State Forest and scattered outlying sections in northeastern Lincoln County.
- Project level - Stand attributes related to old growth, species composition, and structure will be analyzed by harvest area.

COVERTYPE

FIGURES III-1 through *III-3 - PERCENTAGE OF FORESTED ACRES BY COVERTYPE* illustrates the percentage of forested ground that is/was occupied by a particular covertype. These figures compare the historic covertype data of the Upper Flathead Valley to the current and appropriate covertype conditions in the analysis area. The chart displaying Historic conditions is from *Lozensky's* data and covers forested types of a much larger scale than do the Current and Appropriate conditions.

Historic data indicates that mixed-conifer stands are currently

CHAPTER III
EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter contains information related to the Stillwater State Forest environment and the West Fork Timber Sale Project area. The information portrayed is related to the resource issues identified in *CHAPTER I - PURPOSE AND NEED*. Existing or current conditions discussed in this chapter include effects from current and past management and other known disturbances.

The *ALTERNATIVE EFFECTS* section will discuss the direct, indirect, and cumulative effects that No-Action Alternative A, Action Alternative B, and Action Alternative C would likely have on resources. Refer to the appropriate appendices of this EIS for more complete assessments and analyses related to the resources for both scientific and judicial reviews.

DNRC's Stillwater State Forest at Olney

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Road Management (continued)			
		Action Alternative C	
		2.0 miles of Johnson Road would be restricted from public motorized access for 1 year. This additional road restriction may temporarily reduce opportunities for recreational use and contribute to displacement and disturbance to various wildlife species.	Open-road density levels would continue to be met.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Economics			
	Economic benefits	***No-Action Alternative A***	
		No additional income would be provided for the school trust funds. Additional jobs would not be provided.	
		Action Alternative B	
		An estimated $677,900 would be generated to the school trust funds. This alternative would provide an estimated 100 jobs for the duration of the timber sale.	
		Action Alternative C	
		An estimated $359,000 would be generated to the school trust funds. This alternative would provide an estimated 60 jobs for the duration of the timber sale.	
Road Management			
	Currently, more miles of road in the Upper Whitefish Grizzly Bear Subunit is restricted from public motorized use than in the 1996 baseline year.	***No-Action Alternative A***	
		Current access and road restrictions would not change.	Open-road density levels would be met.
		Action Alternative B	
		2.0 miles of Johnson Road would be restricted from public motorized access for 3 years. Similar restrictions for a 2-year period may be applied to either 4.7 miles of Stryker Ridge Road or 5.4 miles of Antice Knob Road. The decisionmaker may select either of these 2 additional restrictions, which may temporarily reduce opportunities for recreational use. Or the decisionmaker may select an option to temporarily exceed open-road density levels (Alternative Practice).	Open-road density levels would be met with closure of Stryker Ridge or Antice Knob roads. With the implementation of the Alternative Practice, the open-road density level may be temporarily exceeded. Implementation of 1 of the 3 options would also contribute to displacement and disturbance to various wildlife species.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Wildlife (continued)			
➢ *Fisher*	Habitat includes areas with dense canopies.	***No-Action Alternative A***	
		No additional effects would be expected.	Minor negative effects due to recent salvage logging and firewood cutting.
		Action Alternative B	
		1,270 acres of habitat would be modified, but travel corridors would be retained. Minor displacement effects would be expected.	Minor negative effects due to recent salvage logging and firewood cutting.
		Action Alternative C	
		775 acres of habitat would be modified, but travel corridors would be retained. Minor displacement effects would be expected.	Minor negative effects due to recent salvage logging and firewood cutting.
➢ *Pileated Woodpecker*	Habitat is limited by the amount of the harvest area at high elevation.	***No-Action Alternative A***	
		No additional effects would be expected.	Pileated woodpecker habitat would increase and, over time, begin to decline.
		Action Alternatives B and C	
		775 acres would be modified, but negligible effects would be expected. Disturbance is expected if harvesting is done during nesting season.	Potential habitat quality and quantity would be reduced. A long-term minor benefit would occur from the regeneration of western larch.
➢ *Big Game*	Habitat is limited to the nonwinter period.	***No-Action Alternative A***	
		No additional effects or increased vulnerability would occur.	
		Action Alternative B	
		Forage would increase, while hiding cover would decrease. The overall effects are negligible.	

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Wildlife (continued)			
➢ *Grizzly Bear*	Year-round habitat is provided. Hiding cover is abundant throughout the project area and in the Upper Whitefish Grizzly Bear Subunit. Precise open-road densities are 31.8 percent and the 1996 baseline was 32.9 percent. Security core is currently 51.6 percent and the 1996 baseline was 43.8 percent.	***No-Action Alternative A***	
		No additional effects would be expected.	No additional effects would be expected.
		Action Alternative B	
		Decreased grizzly bear use of adjacent habitat is expected due to the amount of disturbance. Hiding cover would be reduced, but would be short term and have minor effects. Forage could increase.	Without additional road restrictions, precise open-road densities would be 36.0 percent. With gate restrictions at Site A and with additional restrictions placed on Antice Knob or Stryker Ridge Road, the precise open-road density would not exceed the 1996 baseline (31.4 to 32.7 percent). If the Alternative Practice is implemented, the precise open-road densities could be greater than the 1996 baseline (34 percent). The combined effect of both timber harvesting and native culvert removal would reduce the amount of security core below the baseline (42.7 percent).
		Action Alternative C	
		Decreased grizzly bear use of adjacent habitat is expected due to the amount of disturbance. Hiding cover would be reduced, but would be short term and have minor effects. Forage could increase.	Without additional road restrictions, precise open-road densities would be 34.0 percent. With gate restrictions at Site A, the precise open-road density would not exceed the 1996 baseline (32.7 percent). The combined effect of both activities would reduce the amount of security core, but remain above the baseline (45.5 percent).

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Wildlife (continued)			
Bald Eagle	A bald eagle nest is in the project area.	***No-Action Alternative A***	
		No effects are anticipated.	No additional effects would be expected.
		Action Alternatives B and C	
		No harvesting activities would take place in the nest or primary-use areas. With mitigations, no effects would be expected.	Habitat alterations are expected to be neutral to slightly positive. The reproductive success rate would not be expected to change.
➢ *Canada Lynx*	Although denning habitat was not noted in the proposed harvest areas, foraging habitat was found.	***No-Action Alternative A***	
		Denning habitat would be expected to increase while foraging habitat would decrease.	
		Action Alternative B	
		Some disturbance would occur to Canada lynx travel corridors. Habitat would be modified on 1,270 acres, but as stands regenerate, forage and denning habitats are expected to increase.	For a period of 10 to 20 years, 1,198 acres of lynx habitat would be converted to unsuitable.
		Action Alternative C	
		Some disturbance would occur to Canada lynx travel corridors. Habitat would be modified on 938 acres, but as stands regenerate, forage and denning habitats are expected to increase.	For a period of 10 to 20 years, 866 acres of lynx habitat would be converted to unsuitable.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Wildlife			
Coarse filter: - covertypes and age classes - patch size and interior habitats - connectivity - dead wood	Covertypes favor species that use closed-canopy forests. Key travel areas are not included in the action alternatives. In many unharvested areas, snags range from 0 to 16 per acre; in harvested areas, snag densities appear low. Project design would minimize widespread disturbance during the term of the project.	***No-Action Alternative A***	
		No additional displacement or disturbance would be expected.	A decrease in habitat diversity would favor those animals associated with late-successional forest stages.
		Common to Action Alternatives B and C	
		Disturbance and displacement is expected. This alternative is expected to have the most displacement due to the amount of area being disturbed. Widespread disturbance would not likely occur. Negligible effects would occur to habitat connectivity. Mitigation would provide for species associated with large dead wood. Habitat for species that use forested and interior forests would decrease while habitat for species that use edge and young regenerating stands would increase.	The trend toward achieving appropriate forest covertypes or desired future conditions would benefit species using forests in early successional stages.
		Action Alternative B	
		138 acres would be converted to a western larch/Douglas-fir covertype. Western larch and western white pine would be regenerated and favored for leaving on site on 1,130 acres.	
		Action Alternative C	
		46 acres would be converted to a western larch/Douglas-fir covertype. Western larch and western white pine would be regenerated and favored for leaving on site on 892 acres.	

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Soils (continued)			
Soil Productivity (continued)		***Action Alternative B***	
		Approximately 158 acres would be moderately impacted from skid trails and yarding corridors.	Long-term soil productivity would be maintained and adverse effects would be minimized with application of mitigations.
		Action Alternative C	
		Approximately 131 acres would be moderately impacted from skid trails and yarding corridors.	Long-term soil productivity would be maintained and adverse effects would be minimized with the application of mitigations.
Fisheries			
Populations: - presence - genetics	Bull trout and westslope cutthroat trout both reside in the West Fork and Stryker and Johnson creeks.	***All Alternatives***	
		No impacts are expected beyond those described in *EXISTING CONDITION*.	
Habitat: - flow regime - sediment - channel form - large woody debris - riparian zone - stream temperature - connectivity	Existing conditions likely have had a low to moderate impact on habitat.	***No-Action Alternative A***	
		No impacts are expected beyond those described in *EXISTING CONDITION*.	
		Action Alternatives B and C	
		Increased streamflow may have negligible, if any, impact to habitat. Likely a net positive impact would occur to the sediment component of the habitat for bull trout and westslope cutthroat trout.	Impacts range from negligible to net positive.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Watershed and Hydrology (continued)			
Sediment contributions to streams (continued)		***Action Alternative C***	
		Road improvements would reduce approximately 2.6 tons of sediment per year to the West Fork.	Tons of sediment delivery would drop to 22.9 tons per year in the West Fork; no measurable change in sediment delivery would occur to Johnson Creek.
Water yield	The existing water yield in the West Fork watershed is about 3.4 percent over the naturally occurring level; the Johnson watershed is 3.5 percent; the Swift Creek watershed is 3.4 percent.	***No-Action Alternative A***	
		No change in water yield is expected in the short term.	
		Action Alternative B	
		An increase in water yield of 2.6 percent over the current level would occur in the West Fork watershed; an increase of 0.2 percent would occur in the Johnson Creek watershed; an increase of 0.8 percent would occur in the Swift Creek watershed.	The total increase in water yield above naturally occurring levels would be 6.0 percent in the West Fork watershed, 3.9 percent in the Johnson Creek watershed, and 4.2 percent in the Swift Creek watershed.
		Action Alternative C	
		An increase in water yield of 1.7 percent over the current level would occur in the West Fork watershed; an increase of 0.2 percent would occur in the Johnson Creek watershed; an increase of 0.5 percent would occur in the Swift Creek watershed.	The total increase in water yield above naturally occurring levels would be 5.1 percent in the West Fork watershed, 3.7 percent in the Johnson Creek watershed, and 3.9 percent in the Swift Creek watershed.
Soils			
Soil Productivity	Past harvesting has caused some compaction and displacement of soils.	***No-Action Alternative A***	
		Soil productivity would not be directly affected.	No additional cumulative impacts would occur.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Vegetation (continued)			
Old-growth attributes	Old-growth attribute levels all rate 'medium' within the project area.	***No-Action Alternative A***	
		Old-growth attribute levels would not be affected in the short-term. Attributes, such as decadence, down woody debris, and snags, should increase.	Other Stillwater Unit timber sales that have been harvested or will likely be harvested include 152 acres of old-growth stands that have a medium level of attributes.
		Action Alternative B	
		Old-growth attributes, such as decadence, down woody debris, and snags, should decrease on 286 acres. The abrupt stand edges that may be created could contribute to blowdown.	In addition to the 286 acres of old growth with medium-level attributes proposed for harvesting, 152 acres of old-growth stands with medium-level attributes are in other Stillwater Unit timber sales that have been, or will likely be, harvested.
		Action Alternative C	
		Attribute levels would not be affected in the short term. Attributes such as decadence, down woody debris, and snags should increase.	152 acres of old-growth stands with medium-level attributes are in other Stillwater Unit timber sales that have been, or will likely be, harvested.
Watershed and Hydrology			
Sediment contributions to streams	Currently, 25.5 tons of sediment are delivered annually into the West Fork from roads and stream crossings; 5.2 tons are delivered annually into Johnson Creek.	***No-Action Alternative A***	
		No direct effect beyond those under current management.	Conditions would be similar to existing conditions.
		Action Alternative B	
		Road improvements would reduce approximately 4.2 tons of sediment per year to the West Fork and 2.7 tons per year to Johnson Creek.	Tons of sediment delivery would drop to 21.3 tons per year in the West Fork and to 2.5 tons per year in Johnson Creek.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Vegetation (continued)			
Age class representation on Stillwater Unit (continued)		***Action Alternative B***	
		1,045 acres would be regenerated and added to the 0-to-39-year age class; 695 acres of the 150-year-plus age class would be reclassified in a younger age class.	The trend for managing age-class distributions has been increasing the amount of acres in the 0-to-39-year age class and reducing the amount of acres in the older age classes.
		Action Alternative C	
		713 acres would be regenerated and added to the 0-to-39-year age class; 393 acres of the 150-year-plus age class would be reclassified in a younger age class.	The trend for managing age-class distributions has been increasing the amount of acres in the 0-to-39-year age class and reducing the amount of acres in the older age classes.
Old-growth representation on Stillwater Unit	8,693 acres, or 8.7 percent of the Stillwater State Forest, meet the DNRC old-growth definition	***No-Action Alternative A***	
		No change in old-growth acres.	Due to recent and planned timber sale harvests, old-growth levels would be reduced 152 acres to 8,541 acres.
		Action Alternative B	
		Old-growth on Stillwater Unit would be reduced by 286 acres.	Due to recent and planned timber sales, as well as this alternative, old-growth levels would be reduced by 438 acres, leaving 8,254 acres on Stillwater Unit.
		Action Alternative C	
		No change in old-growth acres.	Due to recent and planned timber sale harvests, old-growth levels would be reduced 152 acres, to 8,541 acres.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS			
RESOURCE	EXISTING CONDITION	DIRECT AND INDIRECT EFFECTS	CUMULATIVE EFFECTS
Vegetation			
Covertype representation on Stillwater Unit	Mixed-conifer covertypes are currently overrepresented and the western larch/ Douglas-fir, western white pine, and lodgepole pine covertypes are underrepresented. The desired future condition for Stillwater State Forest would have more of the western larch/Douglas-fir and western white pine covertypes.	***No-Action Alternative A***	
		No change.	Since 1999, the western larch/Douglas-fir covertype has increased by 4 percent.
		Action Alternative B	
		Approximately 138 acres of mixed-conifer covertype would be converted to the western larch/Douglas-fir covertype. The current covertypes would not change on 1,131 acres proposed for harvesting although representation of the western larch and western white pine covertypes would increase.	Since 1999, the western larch/Douglas-fir covertype has increased by 6 percent.
		Action Alternative C	
		Approximately 46 acres of mixed-conifer covertype would be converted to the western larch/Douglas-fir covertype. The current covertypes would not change on 892 acres proposed for harvesting although representation of the western larch and western white pine covertypes would increase.	Since 1999, the western larch/Douglas-fir covertype has increased by 6 percent.
Age class representation on Stillwater Unit	Currently overrepresented in the 150-year age class and underrepresented in the 0-to-39-year age class.	***No-Action Alternative A***	
		Older age-class representation would continue to increase over time.	The trend for managing age-class distributions has been increasing the amount of acres in the 0-to-39-year age class and reducing the amount of acres in the older age classes.

efforts.

- The earthen berm on North Johnson Road would be removed and a gate installed. This would facilitate harvest and regeneration activities in Harvest Areas III-I through III-M.
- The removal and stabilization of the native culvert sites in Stryker Basin would result in a temporary net decrease in grizzly bear security core from the levels calculated in 1996. The acting Forest Management Bureau Chief has authorized this temporary decrease in security core through an Alternative Practice process (*ARM 36.11.432.1.d.i and ARM 36.11.449*). As a part of the mitigations in the Alternative Practice:
  * The project would be completed in a short time frame (approximately 7 continuous days).
  * The existing rock and gate road closure would be reinstalled. This closure is located at approximately 2.25 miles on Stryker Basin Road.
  * No motorized use would be allowed except those needed for culvert removal.
- In order to meet SFLM Rules for open-road densities, 3 road-management options have been developed. Either the Antice or Stryker Ridge road would be required to have year-round restrictions in place during the year(s) of harvesting Harvest Area III <u>or</u> the decisionmaker could choose to implement an authorized Alternative Practice to allow a temporary increase exceeding the 1996 road-density baseline levels for this project (*ARM 36.11.432.1.c.ii* and *ARM 36.11.449*). For more information, refer to *the ROAD MANAGEMENT section of CHAPTER III*.

MITIGATION MEASURES TO BE APPLIED TO ACTION ALTERNATIVE C

Other than those mitigations common to both alternatives, no additional mitigations have been proposed for Action Alternative C.

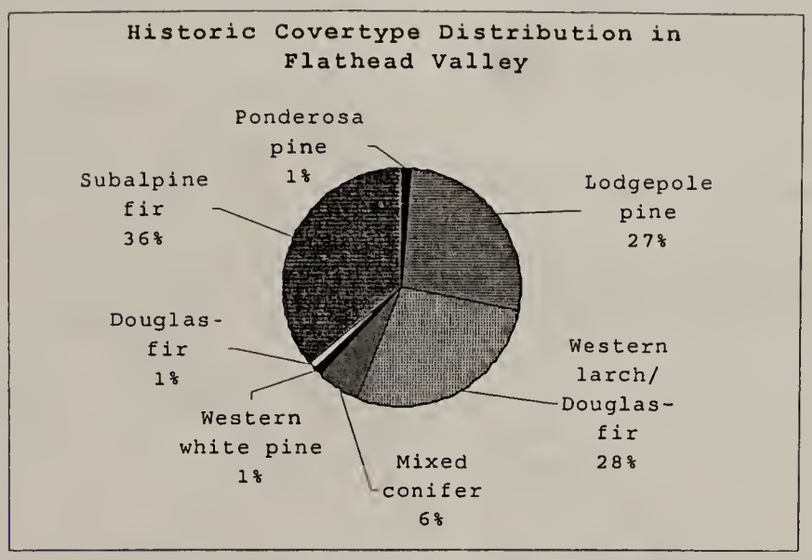
ALTERNATIVES CONSIDERED AND DROPPED FROM FURTHER DEVELOPMENT

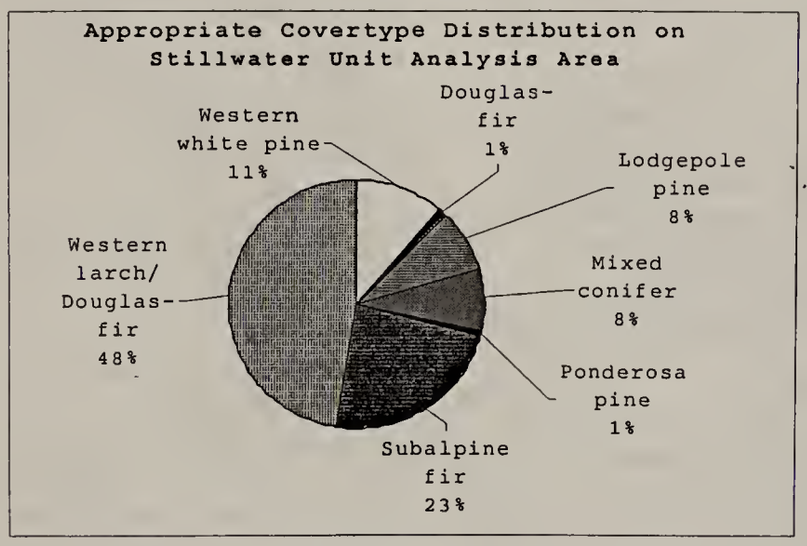
Foresters and DNRC's engineer attempted to locate several routes into Stryker Basin to avoid installing a new bridge at the same location over the West Fork of Swift Creek. Based on feasibility, resource protection, and expense, the existing location of the bridge appears to be the best location. No other alternatives related to accessing Stryker Basin will be considered in this project.

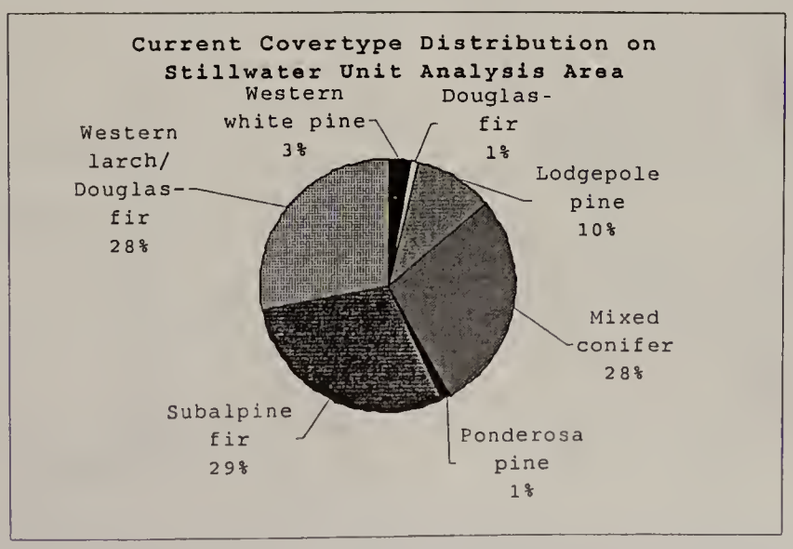
Harvest Areas III-I, III-J, and portions of III-L have a high level of tall brush. Following harvesting operations, the brush has the potential to impede the establishment of natural regeneration and the growth of planted regeneration. The ID Team has investigated the use of herbicides to treat brush within these areas. The ID Team feels that acceptable results can be met by both broadcast burning the harvest areas and supplementing the burning with mechanical site preparation. The successful regeneration and establishment of a new timber stand is a silvicultural priority. If brush competition impedes regeneration, the Department may consider the use of herbicides following a separate environmental review.

overrepresented and the western larch/Douglas-fir, western white pine, and lodgepole pine covertypes are underrepresented on the forest.

FIGURES III-1 THROUGH III-3 - PERCENTAGE OF FORESTED ACRES BY COVERTYPE ON STILLWATER UNIT







AGE-CLASS DISTRIBUTION

Comparing the entire Stillwater State Forest with the historical data from the Upper Flathead Valley, *TABLE III-1- DISTRIBUTION OF AGE CLASSES ON STILLWATER UNIT* shows that Stillwater State Forest is low in the seedling-sapling stands (0 to 39 years old) and high in stands 40 years and older.

TABLE III-1- DISTRIBUTION OF AGE CLASSES ON STILLWATER UNIT

AGE CLASS	HISTORIC PERCENT	CURRENT PERCENT
0 to 39 years	36	10
40 to 99 years	12	23
100 to 150 years	22	19
150+ years	29	48

OLD-GROWTH DISTRIBUTION AND ATTRIBUTES

Approximately 8,693 acres, (8.7 percent) of the coarse-filter analysis area can be classified as old-growth. On the opposite page, *FIGURE III-4 - OLD-GROWTH ON MAIN BLOCK OF STILLWATER STATE FOREST* displays the locations and distribution of old-growth stands on the main block of Stillwater State Forest.

TABLE III-2 - OLD-GROWTH ACRES BY COVERTYPE displays old growth by forest covertype. Covertype is related to habitat type, habitat-type groups, and successional stages. Covertype is used when presenting old growth because the amount can be correlated to *Lozensky's* historic information.

TABLE III-2 - OLD-GROWTH ACRES BY COVERTYPE

CURRENT COVERTYPE	GROSS ACRES BY SLI	OLD GROWTH FIELD-VERIFIED IN WEST FORK PROJECT	TOTALS
Douglas-fir	44		44
Lodgepole pine	398		398
Mixed conifer	1,802	182	1,984
Subalpine fir	3,139	215	3,354
Western larch/ Douglas-fir	2,432		2,432
Western white pine	481		481
Totals	8,296	397	8,693

OLD-GROWTH ATTRIBUTES

DNRC is in the process of developing a tool to assign levels of old-growth attributes to stands by sorting SLI data. The attributes considered are:

- number of large live trees,
- amount of coarse woody debris,
- number of snags,
- decadence,
- structure,
- gross volume, and
- crown density.

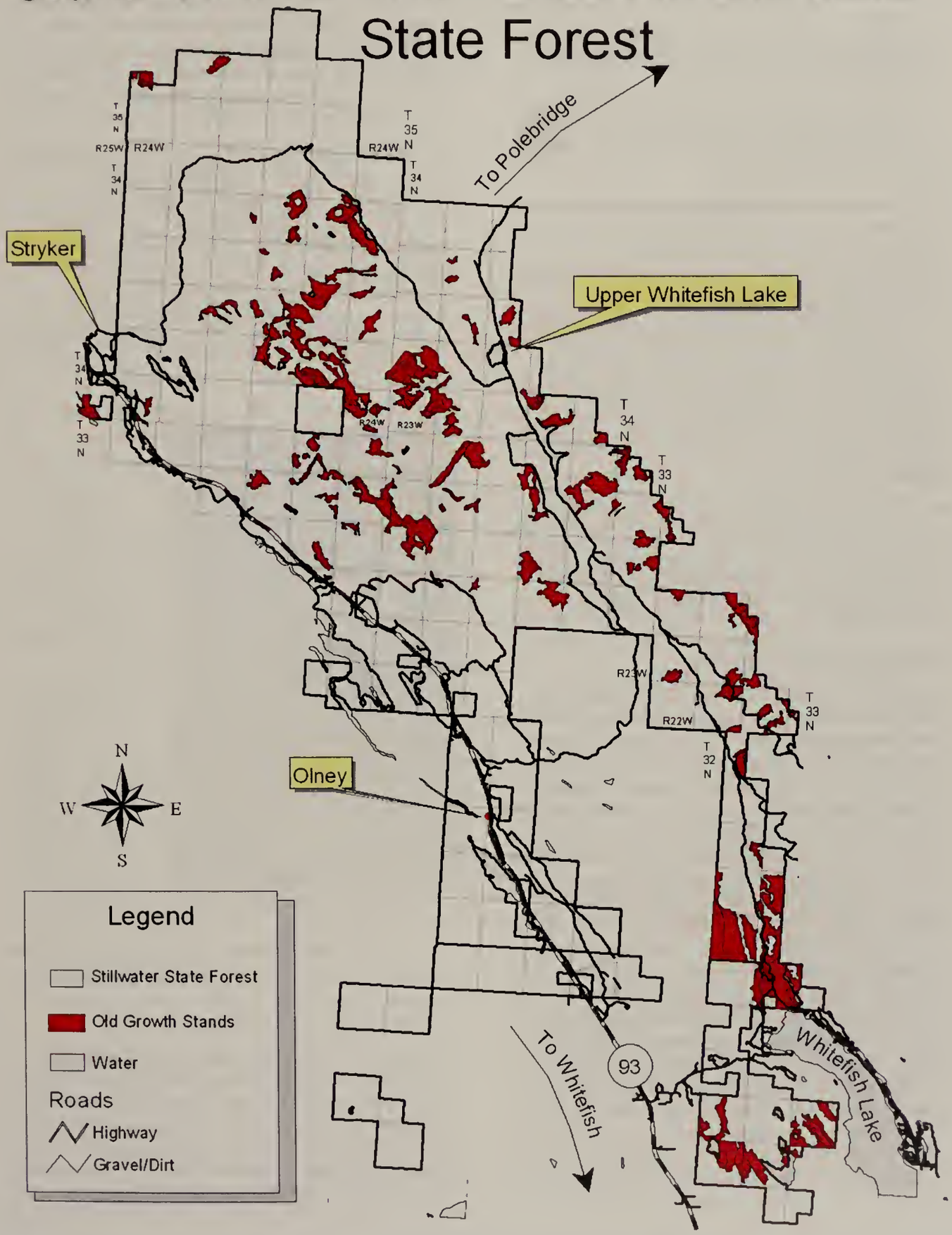
This data sort assigns a value or an index rating to those attributes in an old-growth stand that indicates its total score. These scores can be grouped into low, medium, and high categories to provide an indication of the stand condition in reference to attributes that are often associated with old-growth timber stands. Within the project area, the attribute index ratings are primarily medium.

Some old-growth characteristics in the project area:

- Engelmann spruce and subalpine fir are the dominant tree species in all of the old-growth stands, which total 777 acres.

FIGURE III-4

Old Growth on Main Block of Stillwater State Forest



- Whitebark pine is a component of the overstory and snag attributes in 7 stands, approximately 313 acres.
- Vigor is average to poor in all stands.
- Snag numbers are generally high (greater than 3 per acre).

STAND DEVELOPMENT

The natural processes of stand development and disturbance are influenced by environmental conditions and site characteristics such as soil, stand covertype, forest health, elevation, and stand structure. The stand structures and species component can be greatly modified by natural disturbances such as wildfire and wind events, as well as past management activities.

STAND COVERTYPE

Ninety-five percent of the project area is categorized in the "cool and moist" habitat group and currently 99 percent is represented by the subalpine fir and mixed-conifer covertypes.

TIMBER-STAND HEALTH

Damage and mortality from insects and diseases are relatively minor in the project area. The incidence of western balsam bark beetles and mountain pine beetles have risen since the area was first scouted for this project. Minor levels of spruce beetles, Douglas-fir beetles, and fir engravers, as well as white pine blister rust in the western white pine and whitebark pine, also exist. Indian paint fungus is common in the subalpine fir throughout this area. Additionally, trees have been damaged by wind, snow, ice, and previous logging. This damage has allowed rot to develop in the boles of the trees, resulting in loss of value.

ELEVATION/ASPECT

Elevations in the project area range from 4,300 to 6,500 feet above sea level. The elevation of a stand is important in determining the tree and shrub species present and how fast or slow changes in the stand take place.

A large portion of the project area has a northeast aspect. This exposure, together with the high elevations, account for the high moisture availability and the long duration of snow on the ground. These 2 factors, elevation and aspect, are also the main reasons for the presence of whitebark pine.

STAND STRUCTURE

Approximately 93 percent of the project area is multistoried.

PAST MANAGEMENT ACTIVITIES

Stillwater State Forest has been harvesting timber in the project area since the late 1940s. Many of the stands in Harvest Area II were selectively logged in the late 1940s and early 1950s when Douglas-fir, Engelmann spruce, and western larch were harvested. According to inventory records, western larch, Douglas-fir, and western white pine were present in many of the stands in Harvest Area II in the past, as they are today, but Engelmann spruce and subalpine fir have always been the predominate species. In Harvest Area III, western larch, lodgepole pine, and whitebark pine are a minor component in the stand's canopy composition.

In the early 1980s, infestations of spruce bark beetles occurred and those dead and dying trees were salvage harvested.

In some areas of past logging, desired tree species were able to regenerate with the help of ground scarification. Many areas that did not receive scarification and planting were taken over by shrub species. Regeneration has been slow

and primarily limited to Engelmann spruce and subalpine fir.

FIRE REGIMES

The project area is primarily represented by Fire Group 9 Fire Regime (87 percent of gross acreage), as described by *Fisher/Bradley*. Fire Group 9 represents moist, lower subalpine habitat types where fires are infrequent, but severe, and the effects are long lasting. Stand-replacing fires have been estimated to occur at moderately long to long intervals, 150 to 300 years. The project area also has minor representation in Fire Groups 10 (8 percent), 8 (5 percent), and 7 (less than 1 percent).

The size of the fires in Fire Group 9 will vary from small (in the less severe fire conditions) to large and catastrophic (in the more severe fire conditions that have been experienced in the past few years). In the more severe fire conditions, thousands of acres burn in stand-replacement fires.

The incidence of bark beetle attacks is on the rise in the project area.

The next most common fire regime in the project area is Fire Group 10, which is characterized by the high-elevation forests near and at timberline. Some stands in Harvest Area III are in this regime. Stand-replacing fires, even in the more continuous forests, range in frequency to more than 300 years.

ALTERNATIVE EFFECTS

COVERTYPES AND AGE CLASSES

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Covertypes and Age Classes***

  Covertypes on Stillwater State Forest would not be affected. Older age classes would continue to increase.

- ***Direct and Indirect Effects of Action Alternative B to Covertypes and Age Classes***

  Approximately 138 acres of the mixed-conifer covertype would likely be converted to a western larch/Douglas-fir covertype by planting western larch in some areas and harvesting subalpine fir and Engelmann spruce in other areas. An additional 1,130 acres would be harvested, though the new stands created would still be classified mixed conifer (779 acres) and subalpine fir (351 acres). The representation of western larch and western white pine would likely increase in these covertypes due to site preparation and planting.

  Following site preparation and planting in Harvest Areas II and III, the representation of the 0-to-39-year age class on Stillwater Unit would increase by 1 percent (1,045 acres), and the representation of 150+-year-old stands would be reduced by 0.7 percent (695 acres).

- ***Direct and Indirect Effects of Action Alternative C to Covertypes and Age Classes***

  Approximately 46 acres of the mixed-conifer covertype would likely be converted to a western larch/Douglas-fir covertype by planting western larch and harvesting subalpine fir and Engelmann spruce. An additional 892 acres would be harvested, though the new stands created would still be classified mixed conifer (753 acres) and subalpine fir (139 acres). The

representation of western larch and western white pine would likely increase in these covertypes due to site preparation and planting.

Following site preparation for Harvest Area II, the representation of the 0-to-39-year age class on Stillwater Unit would increase by 0.7 percent (713 acres) and the representation of 150+-year-old stands would be reduced by 0.4 percent (393 acres).

Cumulative Effects

- ***Cumulative Effects of All Alternatives to Covertypes and Age Classes***

  The cumulative effects of timber-stand management on Stillwater State Forest is a trend toward increasing covertypes with western larch, lodgepole pine, and western white pine in areas where recent forest-management activities have taken place. Since the Chicken/Werner Timber Sale Project EIS in 1999, the western larch/Douglas-fir covertype has increased by 6 percent.

  In addition to the changes in covertype distributions from these proposed alternatives, other timber sale projects have been started, but not completed. Thus, their effects are not represented in the Stillwater 2003 SLI. These current projects are expected to increase the amount of area in the 0-to-39-year age class by slightly decreasing the area in the older-stand age classes.

OLD-GROWTH DISTIRBUTION AND ATTRIBUTES

Direct Effects

- ***Direct Effects of No-Action Alternative A and Action Alternative C to Old-Growth Distribution and Attributes***

  The distribution or attributes of old-growth stands would not be affected in the short term.

- ***Direct Effects of Action Alternative B to Old-Growth Distribution and Attributes***

  Old-growth levels on Stillwater Unit would be decreased by approximately 286 acres; an estimated 8,406 acres of potential old growth would remain. This harvest would remove 203 acres from the mixed-conifer covertype and 83 acres from the subalpine fir covertype.

  The locations where harvesting would affect the distribution of old-growth stands is shown on *FIGURE III-5 - WEST FORK OLD-GROWTH MAP*. Most of the attributes associated with the old-growth stands that would be harvested would be removed.

Indirect Effects

- ***Indirect Effects Common of All Alternatives to Old-Growth Distribution and Attributes***

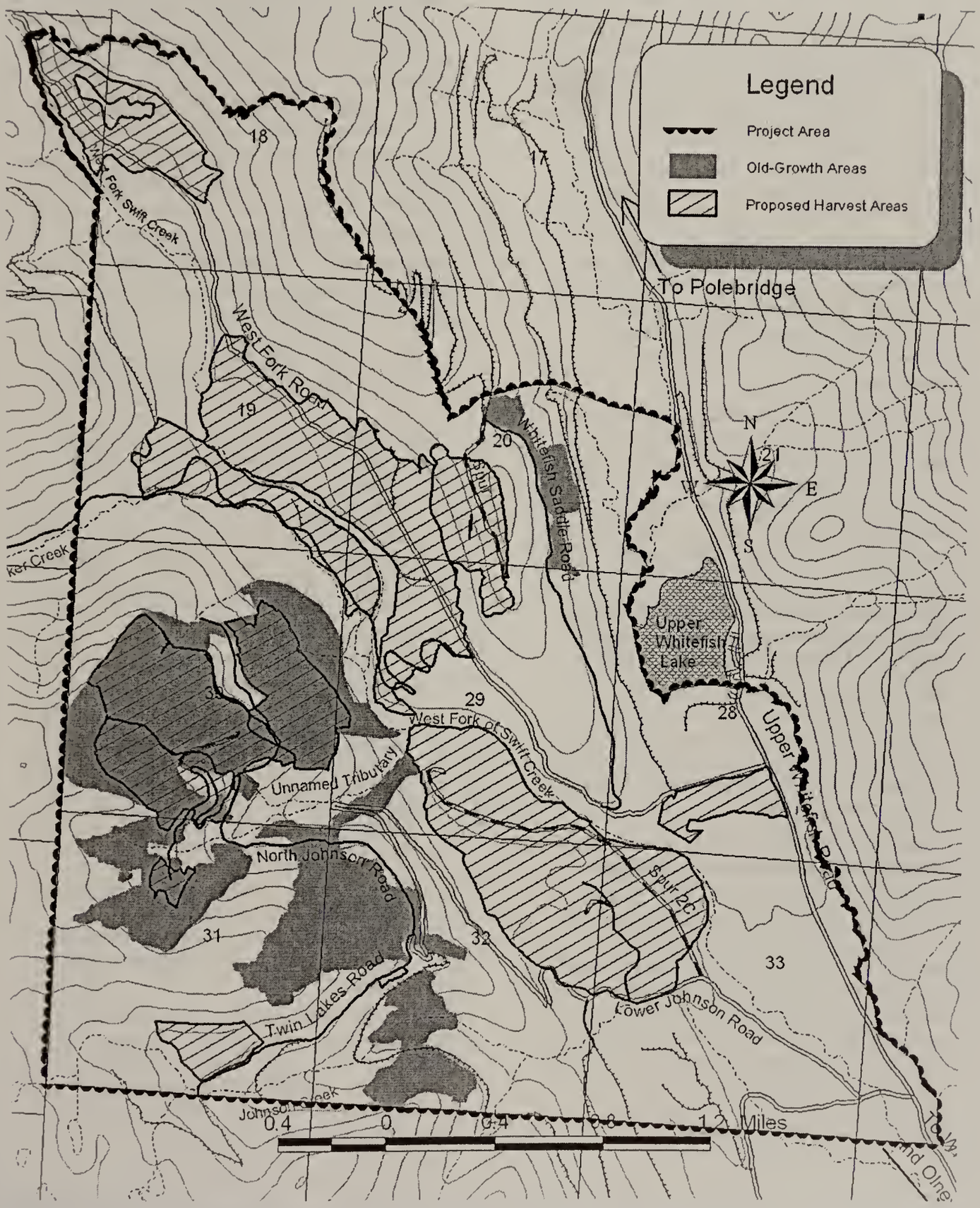
  Stands currently meeting DNRC's old-growth definition would become more decadent. Stocking levels and down woody debris would increase in some stands and covertypes, increasing wildfire hazards. Species that are shade tolerant would remain dominant in stands. Various factors, such as insect infestations, disease infections, and decreasing vigor, would eventually cause more snags in portions of the stands. White pine blister rust, mountain pine beetles, and weather-related damage would increase the amount of snags in old-growth stands.

- ***Indirect Effects of Action Alternative B to Old-Growth Distribution and Attributes***

  Portions of old-growth stands would be harvested and create more abrupt stand edges structurally. The risk of blowdown along the proposed unit boundaries would increase. Harvest areas next to remaining old-growth stands could possibly act as fuel breaks that would slow or stop wildfires before they reach the old-growth stands.

Figure III-5

WEST FORK OLD-GROWTH MAP



Cumulative Effects

- ***Cumulative Effects Common of All Alternatives to Old-Growth Distribution and Attributes***

  Approximately 48 acres of field-verified old growth are planned for harvesting in the Taylor South Timber Sale Project area. Approximately 104 acres of old growth, field verified or SLI identified, have been harvested with the Chicken/Werner Timber Sale. In total, an estimated 59 acres of old growth would be removed from the mixed-conifer covertype, an estimated 81 acres from the western white pine covertype, and an estimated 12 acres from the Douglas-fir covertype.

  SLI originally classified these 152 acres as having medium attribute levels. These stands would no longer meet DNRC's old-growth definition following harvesting, and, at the most, would be rated as having low attributes levels.

- ***Cumulative Effects Common of No-Action Alternative A and Action Alternative C to Old-Growth Distribution and Attributes***

  Old-growth on Stillwater Unit would be reduced to an estimated 8,541 acres; approximately 8.6 percent. The percentage of old-growth acres by covertype would change very little.

- ***Cumulative Effects of Action Alternative B to Old-Growth Distribution and Attributes***

  Old-growth on Stillwater Unit would be reduced to an estimated 8,254 acres; approximately 8.3 percent. The representation of both the mixed-conifer and western white pine covertypes would be reduced by approximately 1 percent; the representation of the western larch/Douglas-fir covertype would increase by approximately 1 percent.

STAND DEVELOPMENT

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Stand Development***

  Stand development within the project area would not be directly affected. As stands age over time, natural forest succession and fire suppression would reduce the variability of covertypes both on the forest landscape and in the project area.

- ***Direct and Indirect Effects of Action Alternative B to Stand Development***

  Stand development would be directly affected by:

  - taking on the role of a stand-replacing fire in Harvest Area III by:
    - removing overstory trees, including those affected by insects and diseases;
    - reducing fuels; and
    - following subsequent site preparation to enhance western larch, Douglas-fir, western white pine, and whitebark pine regeneration.
  - taking on the role of a moderately-severe fire in Area II by:
    - creating a vegetative mosaic by removing some overstory trees, including those affected by insects and diseases;
    - reducing fuels, and
    - following subsequent site preparation to enhance the regeneration of western larch, Douglas-fir, and western white pine.

  The resultant effect on stand development across the project area is that the forest would contain a mosaic of structures that include single-storied, two-storied, and multistoried conditions. Through harvesting, the structure changes would

emulate the type of fire regime associated with the covertype. Fire regime simulations would range from stand-replacing to mixed-severity, depending on the type of site preparation and the extent that site preparation can actually be employed.

- ***Direct and Indirect Effects of Action Alternative C to Stand Development***

  Stand development would be directly affected by taking on the role of a moderately severe fire in Harvest Area II and creating a vegetative mosaic by:

  - removing some overstory trees, including those affected by insects and diseases,
  - reducing fuels, and
  - following subsequent site preparation to enhance the western larch, Douglas-fir, and western white pine regeneration.

  The resultant effect on stand development across the project area is that the forest would contain a mosaic of structures that include single-storied, two-storied, and multistoried conditions. Through harvesting, the structure changes would emulate the type of fire regime associated with the covertype. Fire regime simulations would range from stand-replacing to mixed-severity, depending on the type of site preparation and the extent that site preparation can actually be employed.

Cumulative Effects

- ***Cumulative Effects of All Alternatives to Stand Development***

  Forest succession and stand development would continue as determined by site conditions, weather, timber management, and those factors discussed under *EXISTING CONDITIONS*.

WATERSHED AND HYDROLOGY ANALYSIS

INTRODUCTION

ANALYSIS AREA

The hydrologic environment affected by the proposed West Fork Timber Sale Project proposal includes the West Fork watershed and all of its tributaries.

ANALYSIS METHODS

Analysis methods used to evaluate the existing conditions and to assess the potential impacts to hydrology include an inventory of sediment sources, assessments of channel stability, and computer modeling of the annual water yield.

EXISTING CONDITIONS

- ***MONTANA SURFACE WATER QUALITY STANDARDS***

  According to *ARM 17.30.608 (1)(c)*, the Whitefish Lake drainage, including Swift Creek, is classified as A-1. For a description of criteria associated with A-1 waterbodies, refer to *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*. Designated beneficial water uses within the project area include cold-water fisheries and recreational use in the stream, wetlands, lake, and surrounding area.

- ***WATER-QUALITY-LIMITED WATERBODIES***

  Swift Creek and the West Fork are currently listed as water-quality-limited waterbodies in the 1996 and 2004 303(d) list. For a more detailed description of management implications in water-quality-limited waterbodies, refer to *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*. The current listed causes of impairment in Swift Creek are bank erosion, other habitat alterations, and nutrients. The probable source for Swift Creek is listed as silviculture. Current listed causes of impairment in the West Fork are flow alteration, other habitat alteration, and siltation. The probable sources for the West Fork are listed as *silviculture and highway maintenance and runoff*. A Total Maximum Daily Load (TMDL) assessment is scheduled to be completed in 2011 for the Swift Creek drainage.

- ***MONTANA STREAMSIDE MANAGEMENT ZONE (SMZ) LAW***

  By the definition in *ARM 36.11.312 (3)*, the majority of the West Fork and Johnson watersheds are class 1 streams. Some of the smaller first-order tributaries may be classified as class 2 or 3, based on conditions at specific sites. For a description of criteria for classification of streams, refer to *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*.

Surveys of channel stability show that stream channel conditions in the West Fork watershed are primarily good to fair; 6 reaches were rated in poor condition. An adequate supply of large woody debris was found. Little evidence of past streamside harvests was noted. Where past logging had taken place in the riparian area, a shortage of existing or potential downed woody material in the streams was not evident.

The proposed project area was reviewed to see whether roads and stream crossings are sources of sediment. The road system in the West Fork watershed is contributing approximately 25.5 tons of sediment per year to streams. Roads in the Johnson Creek watershed are contributing about 5.2 tons of sediment per year to streams. Much of the existing road system in the proposed project area meet applicable BMPs. Surface drainage on the road systems in Stryker Basin, Herrig Basin, and on the main roads in the West Fork watershed have been installed with past projects.

Four wooden crossing structures surfaced with road-fill material exist on perennial tributaries to

the West Fork. Each is collapsing into the creek and is an existing sediment source to the West Fork.

An analysis of water yield in the West Fork watershed showed that past activities have produced a 3.4 percent water-yield increase over a fully forested condition. This level is much less than the 10 percent threshold of concern recommended for water-yield increases in the watershed.

This native bridge has collapsed into the creek, contributing sediment to the stream.

This dirt-covered old wooden bridge has been overgrown with vegetation and would eventually collapse and contribute sediment to the stream.

ALTERNATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A***

  No direct effects to sediment delivery or water yield would occur beyond those under current management.

- ***Direct and Indirect Effects Common to Action Alternatives B and C***

  The wooden bridge spanning the West Fork on the Stryker Basin Road would be replaced under either proposed action alternative. Also, 3 log crossings with earthen fill would be removed and the streambanks rehabilitated in the upper reaches of Stryker Basin. The proposed work on these sites would contribute sediment to the West Fork only while crews are operating. Sediment contribution would be minimized through BMPs and erosion-control measures. These projects would reduce the annual sediment delivery by approximately 2.33 tons of sediment per year and remove about 750 tons of bridge fill that would eventually fall into the creek if the sites are not repaired.

- ***Direct and Indirect Effects of Action Alternative B***

  Several stream crossings would be replaced in the West Fork and Johnson Creek watersheds along approximately 31 miles of existing road. This work would lower the annual sediment load to the West Fork by approximately 4.2 tons, and to Johnson Creek by approximately 2.7 tons.

  Ground-based yarding would increase the risk of sediment delivery by exposing soil in skid trails. Building approximately 3.4 miles of new and temporary road would also expose bare soil.

  Water yield would increase by approximately 2.6 percent over the

current level in the West Fork watershed and 0.4 percent in the Antice/Johnson watershed.

- ***Direct and Indirect Effects of Action Alternative C***

  Several stream crossings would be replaced in the West Fork watershed along approximately 25 miles of existing road. This work would lower the annual sediment load to the West Fork by approximately 2.6 tons.

Though erosion-control measures would be taken, temporary increases in sediment to the streams would occur temporarily during the installation of culverts or bridges. Once installed, the annual sediment delivery would be less than the current amount.

Ground-based yarding would increase the risk of sediment delivery by exposing soil in skid trails. Building approximately 2 miles of new and temporary road would also expose bare soil.

Annual water yield would increase by approximately 1.7 percent over the current level in the West Fork watershed and approximately 0.2 percent in the Antice/Johnson watershed.

Ground-based yarding would increase the risk of sediment delivery by exposing soil in skid trails. Harvesting activities would not occur within 100 feet of the West Fork or Stryker and Johnson creeks.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A***

  The cumulative effects would be similar to those described in the existing conditions for water yield and sediment delivery.

- ***Cumulative Effects of Action Alternative B***

  Cumulatively, the total sediment load to the West Fork would increase over existing conditions. Road construction, culvert replacements, and bare soil from harvest areas would produce a higher risk of sediment delivery for a year or two. In the long term, sediment delivery would drop from approximately 25.5 tons per year to approximately 21.3 tons per year in the West Fork. Due to road repairs, the annual sediment delivery to Johnson Creek would drop from approximately 5.2 tons per year to approximately 2.5 tons.

  Water yield in the West Fork watershed would rise from the current level of about 3.4 percent over fully forested to about 6.0 percent, and would rise from 3.5 percent to 3.9 percent in the Antice/Johnson watershed. This water yield has a low risk of creating adverse cumulative effects to channel stability from increases in streamflow.

- ***Cumulative Effects of Action Alternative C***

  Cumulatively, the total sediment load to the West Fork would increase over existing conditions. Road construction, culvert replacements, and bare soil from harvest areas would produce a higher risk of sediment delivery for a year or two. In the long term, due to road repairs, sediment delivery to the West Fork would decrease from approximately 25.5 tons of sediment delivery per year to approximately 22.9 tons.

  Water yield in the West Fork watershed would rise from its current level of approximately 3.4 percent over fully forested to approximately 5.1 percent, and would rise from 3.5 percent to 3.7 percent in the Antice/Johnson watershed. This water yield has a low risk of creating adverse cumulative effects to channel stability from increases in streamflow.

SOILS ANALYSIS

INTRODUCTION

The processes of glaciers and rivers have formed the valley of the Swift Creek watershed. Deep glacial tills are the dominant soil types found in the project area. The ridges and upper slopes are weathered bedrock scoured by glaciers.

ANALYSIS METHODS

The productivity of the soil will be analyzed by evaluating the current levels of disturbance to the soils in the project area. The risk factors of soil stability will be included in the analysis criteria.

ANALYSIS AREA

The project area is the analysis area for evaluating soil productivity. This analysis area is within both the West Fork and Antice/Johnson watersheds.

EXISTING CONDITIONS

DNRC has conducted timber harvesting in the West Fork watershed since the 1940s. Since the 1960s, 3,291 acres of State land has been harvested with a combination of ground-based and cable-yarding equipment. Ground-based yarding equipment may displace and compact the surface layers of soil, mainly on heavily used trails, which affects soil productivity. Field reconnaissance shows that many of the trails used during past harvesting are well vegetated, and frost action and vegetative growth are continuing to lessen the impacts.

The soil types in the project area vary from nearly level wetland types along the West Fork to steep valley sideslopes on ridges. The Flathead National Forest Soil Survey identified one area of soils in the project area at high risk for mass movements. Though this soil type, landtype 74, is found in the northern portion of the project area, no slope failures were identified during reconnaissance.

ALTERNATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Soils***

  Soil productivity would be neither directly nor indirectly affected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Soils***

  Action Alternative B would have direct impacts on approximately 158 acres. Direct impacts would include compaction and displacement from skidding logs with ground-based equipment on approximately 937 acres and cable-yarding equipment on approximately 333 acres.

  Action Alternative C would have direct impacts on approximately 131 acres. Direct impacts would include compaction and displacement from skidding logs with ground-based equipment on approximately 866 acres and cable-yarding equipment on approximately 72 acres.

  For both action alternatives, site preparation and road construction with ground-based equipment would also generate direct impacts to the soil. *TABLE III-3 - SUMMARY OF DIRECT EFFECTS OF ALTERNATIVES ON SOILS WITH SUMMER HARVESTING* summarizes the expected impact to soils. These activities would leave up to 12 percent of the proposed harvest units in an impacted condition under Action Alternative B, and up to 14 percent under Action Alternative C. Mitigation measures would be implemented to maintain soil productivity in the long term and control the area and degree of negative soil impacts to less than 15 percent of the proposed harvest area. Skidding mitigation measures would include:

  - restricting the season of use;
  - utilizing a minimum skid-trail spacing;

TABLE III-3 - SUMMARY OF DIRECT EFFECTS OF ALTERNATIVES ON SOILS WITH SUMMER HARVESTING

DESCRIPTION OF PARAMETER	NO-ACTION ALTERNATIVE A	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
Acres of harvest	0	1,270	938
Acres of tractor yarding	0	937	866
Acres of skid trails and landings[1]	0	188	173
Acres of cable yarding	0	333	72
Acres of yarding corridor[2]	0	33	7
Acres of moderate impacts[3]	0	158	131
Percent of harvest area with impacts	0%	12.4%	14.0%

[1]20 percent of ground-based area
[2]5 to 10 percent of cable-yarding units
[3]75 percent of ground-based skid trails and 50 percent of cable corridors

- installing erosion-control devices where needed;
- retaining woody debris; and
- following all applicable BMPs.

Coarse woody debris would be retained for nutrient cycling.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A to Soils***

  No soil would be disturbed and no past harvest units would be reentered; therefore, this alternative would have no cumulative impacts on soil productivity and would be similar to the *EXISTING CONDITION* portion of this analysis.

- ***Cumulative Effects of Action Alternatives B and C to Soils***

  Several stands where previous timber management has occurred would be entered. Cumulative effects may occur from repeated entries into a stand where additional ground is impacted by equipment operations. Long-term soil productivity would be maintained and adverse cumulative effects would be minimized by implementing one or more mitigations:

  - Existing skid trails from past harvesting activities would be used if properly located and spaced.
  - Additional skid trails would be used only where existing trails are unacceptable.
  - Soil-moisture restrictions, season of operation, and methods of harvesting would mitigate the potential direct and indirect effects.
  - A portion of coarse woody debris and fine litter would be retained for nutrient cycling.

  In previously harvested stands, cumulative effects to soil productivity from multiple entries would be the same as those listed under *DIRECT AND INDIRECT EFFECTS*.

FISHERIES ANALYSIS

INTRODUCTION

This analysis describes the fisheries resources, displays the anticipated effects of each alternative of this proposal, and summarizes the detailed effects analysis in *APPENDIX E - FISHERIES ANALYSIS*.

Native cold-water fish species in the project area include bull trout, westslope cutthroat trout, slimy sculpin, largescale sucker, and longnose sucker. The eastern brook trout is the one nonnative species known to persist within the project area.

Bull trout and westslope cutthroat trout are the primary cold-water species that will be addressed. The bull trout is listed as "threatened" under the Endangered Species Act. Both bull trout and westslope cutthroat are listed as Class-A Montana Species of Concern, and DNRC has identified them as sensitive species.

ANALYSIS METHODS

The best available data for both fish populations and habitats will be presented for the 2 basins and 3 subbasins in the project area. The existing conditions and foreseeable alternative effects for each subbasin will be explored using the following outline of subissues:

- Populations
  - presence
  - genetics
- Habitat
  - flow Regime
  - sediment
  - channel form
  - large woody debris
  - riparian zone
  - stream temperature
  - connectivity
  - cumulative impacts (in *ALTERNATIVE EFFECTS* only)

ANALYSIS AREA

The project area includes the watersheds of 2 major tributaries of Swift Creek: West Fork of Swift Creek (West Fork) and East Fork of Swift Creek (East Fork). Also included in the project area are 2 specific subbasins of the West Fork: from north to south, the watersheds of Stryker Creek and Johnson Creek.

The East Fork will not be included in the fisheries analysis since no foreseeable direct, indirect, or cumulative impacts to bull trout or westslope cutthroat trout populations or habitat are expected as a result of any of the alternatives.

EXISTING CONDITIONS

POPULATIONS

➢ **Presence**

The West Fork has been identified as critical habitat for bull trout as part of the Endangered Species Act (*USFWS 2002a)* and part of a disjunct bull trout population (MBTSG 1995). This subbasin is likely used by bull trout. The annual number of bull trout redds found in the West Fork has ranged from 0 to 8 during the years of 1994 through 2003. No westslope cutthroat trout redds were found during surveys in 2000 through 2002.

In Johnson and Stryker creeks, bull trout populations may utilize the lower reaches of the creeks as spawning and rearing habitat. Also, the possibility exists that the lower reaches of the streams could be utilized to some degree by an adult bull trout. Johnson Creek most certainly provides some level of spawning and rearing habitat to westslope cutthroat trout.

Due to the lack of data on historic and comparable population presence, no apparent existing direct and indirect impacts to

bull trout and westslope cutthroat trout population presence exist in the West Fork and Stryker and Johnson creeks.

- **Genetics**

Site-specific information regarding bull trout genetics in the West Fork is unavailable, but some level of hybridization has possibly occurred with eastern brook trout in the West Fork subbasin. The genetic purity of westslope cutthroat trout was determined to be 97.4 percent in a 1984 DFWP genetic survey.

Due to the possibility of bull trout and brook trout hybridization and the known occurrence of crossbred westslope cutthroat trout, low to moderate direct and indirect impacts to bull trout and westslope cutthroat trout population genetics exist in the West Fork.

Information regarding the existing conditions of bull trout genetics in Stryker Creek is the same as that for the West Fork. Regarding westslope cutthroat trout, a possibility exists that genetic crossbreeding within the West Fork has spread upstream into Stryker Creek. Conversely, a remnant population of westslope cutthroat trout in the upstream reaches of Stryker Creek that may be genetically pure is also a possibility.

Information regarding the existing conditions of bull trout genetics in Johnson Creek is the same as that for the West Fork. Regarding westslope cutthroat trout, DFWP conducted a genetic survey in 1992 of 52 fish from lower Johnson Creek. The subspecies was found to be slightly crossbred (98.9 percent) with Yellowstone cutthroat trout. A DFWP genetic survey in 1998 of 3 fish from an upstream reach of Johnson Creek found samples to be genetically pure.

Due to the possibility of bull trout and brook trout hybridization and the potential occurrence of crossbred cutthroat trout, existing low to moderate direct and indirect impacts to bull trout and westslope cutthroat trout population genetics are possible in Stryker and Johnson creeks.

HABITAT

- **Flow Regime**

Changes in flow regime have been known to affect the bull trout and westslope cutthroat trout spawning migration, spawning habitat availability, and embryo survival.

The hydrology analysis for the West Fork basin indicates that the existing average flow regime for the stream is approximately 3.4 percent above the range of naturally occurring conditions (see *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*). Stryker Creek has an average flow regime of 3.3 percent above naturally occurring. Johnson Creek has an estimated flow regime of 3.5 percent over naturally occurring levels.

Due to the current flow-regime values, a very low potential for direct and indirect impacts related to the flow-regime component of bull trout and westslope cutthroat trout habitat exist in the West Fork and Stryker and Johnson creeks.

- **Sediment**

Existing stream-sediment processes that are described in this Fisheries Analysis are *Rosgen* stream-morphological type, sediment budget, and streambank stability. The stream morphology (general shape of the stream) of the West Fork through the project area is exhibiting a B3/B4 under the 35-percent threshold for 'threatened' status. Substrate score samples show values that are

considered not 'threatened'. Two *Wolman* pebble-count surveys from 2001 indicate that 8.5 percent of the streambed surface substrates are less than 8 millimeter. This is considerably lower than the results calculated for the similar size class in the *McNeil* core samples. A streambank-stability survey from 2001 indicates very high levels (99.19 percent) of streambank stability in the West Fork throughout the project area. Based on these observations, no direct and indirect impacts to the sediment component of bull trout and westslope cutthroat trout habitat exist in the West Fork.

Field surveys of Stryker Creek within the project area have found the *Rosgen* stream morphological type to be B3, with stream gradients ranging primarily from 4 to 6 percent. Field surveys of Johnson Creek within the project area have found the *Rosgen* stream morphological type to be B4 with a stream gradient of, primarily, 3 percent. Stream stability scores from reaches within the project area are considered fair for these stream types.

Based on these observations, no direct and indirect impacts to the sediment component of bull trout and westslope cutthroat trout habitat likely exist in the West Fork and Stryker and Johnson creeks.

- **Channel Forms**

Two descriptions of channel formation will be used to describe existing habitat for bull trout and westslope cutthroat trout in the West Fork:

- *Montgomery/Buffington* classification
- R1/R4 Fish Habitat Standard Inventory

The stream formations of the West Fork through the project area are broadly described as exhibiting both 'pool-riffle' and 'forced pool-riffle' (*Montgomery/Buffington* classifications). R1/R4 Fish Habitat Standard Inventory data indicates that the West Fork likely provides an average quantity of pool habitat within the project area.

Moving upstream through the project area, the stream formation of Stryker Creek is broadly described as a transitional zone between 'forced pool-riffle' and 'plane bed' (*Montgomery/Buffington* classifications) to 'forced step-pool' and 'step-pool' (*Montgomery/Buffington* classifications).

From the confluence with the West Fork and upstream to river mile 1.46, the stream formations of Johnson Creek, are broadly described as exhibiting both 'pool-riffle' and 'forced pool-riffle' (*Montgomery/Buffington* classifications). The stream formations from river mile 1.46 upstream through the project area to river mile 3.05 are broadly described as exhibiting 'step-pool', 'forced step-pool', and some 'cascade' (*Montgomery/Buffington* classifications).

Although insufficient historic data is available for describing existing trends in channel forms, no direct and indirect impacts to the channel-form component of bull trout and westslope cutthroat trout habitat likely exist in the West Fork or Stryker and Johnson creeks.

- **Large Woody Debris**

The average large woody-debris count in the West Fork is 50 pieces per 1,000 feet. This data suggests that existing amounts of large woody debris in the West Fork are below average. Based on these observations, low to moderate direct and indirect

impacts to the large woody debris component of bull trout and westslope cutthroat trout habitat exist in the West Fork.

The large woody debris count in Stryker Creek averages 131 pieces per 1,000 feet. This data suggests that existing amounts of large woody debris in Stryker Creek are average. Consequently, no direct and indirect impacts to the large woody component of bull trout and westslope cutthroat trout habitat exist in Stryker Creek.

Although specific historic data is not available to describe existing trends of large woody debris in Johnson Creek, low to moderate direct and indirect impacts to the large-woody-debris component of bull trout and westslope cutthroat trout habitat likely exist in Johnson Creek.

- **Riparian Zone**

  Existing impacts to the riparian zone from past timber harvests on the bull trout and westslope cutthroat trout habitats are low to moderate in the West Fork; no direct and indirect impacts exist in Stryker or Johnson creeks.

- **Stream Temperature**

  During the 2 seasons of record in the lower half of the project area, the weekly maximum stream temperature change in the West Fork ranged from 0.3 to 1.9 degrees Celcius.

  Although sufficient data is unavailable for describing existing trends in stream temperature in the West Fork or Stryker and Johnson creeks, no direct and indirect impacts to bull trout and westslope cutthroat trout habitat likely exist as a result of stream temperature.

- **Connectivity**

  No natural or manmade barriers to bull trout and westslope cutthroat trout migration occur in the project area on the West Fork or Stryker Creek. No direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of disconnectivity exist on either stream.

  Currently, the 3 bridge crossings on Johnson Creek within the project area provide full passage of all life stages of bull trout and westslope cutthroat trout. One culvert is located within the project area on a lower reach of Johnson Creek with seasonal, discontinuous flow. This culvert is likely a migration barrier to all life stages of bull trout and westslope cutthroat trout, except for a portion of the strongest swimming adults. Due to a very limited potential for upstream migration through this culvert, moderate direct and indirect impacts to the connectivity component of bull trout and westslope cutthroat trout habitat exist in Johnson Creek.

SUMMARY OF EXISTING CONDITIONS

West Fork

* An estimated 3.4 percent increase in streamflow over naturally occurring conditions may have resulted in changes to channel formation, sediment levels, and streambank stability.

* Past individual-tree-selection harvest methods in riparian zones have likely reduced the amount of potentially recruitable large woody debris to the West Fork; this could be associated with the existing below-average amounts of large woody debris in the stream.

* Past canopy removal in riparian areas may have led to temporarily increased stream temperatures as a result of increased direct solar energy, but to accurately qualify the extent of this potential past impact is not possible.

* In the project area, an estimated 25.5 tons of sediment from existing roads are contributed annually to streams in the West Fork watershed.

Overall, low to moderate collective past and present impacts to bull trout and westslope cutthroat trout are likely in the West Fork as a result of the existing conditions described above.

Stryker and Johnson Creeks

Stryker Creek

* An estimated 3.3 percent increase in the streamflow may have resulted in changes to channel formation, sediment levels, and streambank stability.
* In the project area, an estimated 2.8 tons of sediment from existing roads are contributed annually to streams in the Stryker Creek watershed.

Johnson Creek

* An estimated 3.5 percent increase in the streamflow regime may have resulted in changes to channel formation, sediment levels, and streambank stability.
* Past individual-tree-selection harvest methods in riparian zones along Johnson Creek may have reduced the amount of potentially recruitable large woody debris to the stream and increased incoming direct solar energy.
* In the project area, an estimated 5.2 tons of sediment from existing roads are contributed annually to streams in the Johnson Creek watershed.

Overall, low to moderate collective past and present impacts to bull trout and westslope cutthroat trout are possible in Stryker and Johnson creeks as a result of the existing conditions described above.

ALTERNATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS

Populations

➢ ***Presence and Genetics***

- ***Direct and Indirect Effects of All Alternatives***

  No direct or indirect impacts would occur beyond those described under *EXISTING CONDITIONS*.

Habitat

➢ ***Flow Regime***

- ***Direct and Indirect Effects of No-Action Alternative A***

  No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternatives B and C***

  The approximate range of potential water-yield increases to streams in the project area is 0.4 to 2.6 percent under Action Alternative B and 0.2 to 1.6 percent with Action Alternative C. With respect to those existing conditions described in the *APPENDIX E - FISHERIES ANALYSIS*, these potential modifications of flow regimes are expected to have little impact to the flow-regime component of bull trout and westslope cutthroat trout habitat beyond those described under *EXISTING CONDITIONS*.

➢ ***Sediment***

- ***Direct and Indirect Effects of No-Action Alternative A***

  No impacts are expected beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternatives B and C***

  Data from *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS* indicates the range of potential water-yield increases would be

generally insufficient to facilitate the development of unstable stream channels, which could adversely affect the sediment component of bull trout and westslope cutthroat trout habitat. *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS* also indicates that road improvements would reduce sediment. Timber-harvesting operations would comply with the SMZ laws. With respect to the earlier-described existing conditions, these alternatives would likely provide net positive impacts to the sediment component of bull trout and westslope cutthroat trout habitat.

➢ *Channel Forms*

- ***Direct and Indirect Effects of No-Action Alternative A***

  No impacts are expected beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternatives B and C***

  Potential changes to stream channel forms are primarily a function of modifications to flow regimes and consequent relationships with existing sediment size classes. As indicated earlier, modifications to the bull trout and westslope cutthroat trout habitat components of flow regime and sediment are expected to be negligible or not occur at all. With respect to the existing conditions described earlier, no foreseeable direct and indirect impacts to the channel form component of bull trout and westslope cutthroat trout habitat would be expected beyond those described under *EXISTING CONDITIONS*.

➢ *Large Woody Debris*

- ***Direct and Indirect Effects of No-Action Alternative A***

  No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternatives B and C***

  Since a 100-foot, no-harvest buffer would be established between the 3 streams and the associated proposed harvest areas, the rate of potential large-woody-debris recruitment would not likely be affected by any proposed harvest area. No direct or indirect impacts to the large-woody-debris component of bull trout and westslope cutthroat trout habitat would be expected beyond those described under *EXISTING CONDITIONS*.

➢ *Riparian Zone*

- ***Direct and Indirect Effects of No-Action Alternative A***

  No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternatives B and C***

  The capability of the riparian-zone function to provide potential was evaluated. Since a no-harvest buffer of 100 feet would be established between the 3 streams and the associated proposed harvest areas, the riparian-zone function associated with these 3 stream channels would likely not be affected. No direct or indirect impacts to the riparian-zone component of bull trout and westslope cutthroat trout habitat would be expected beyond those described under *EXISTING CONDITIONS*.

➢ *Stream Temperature*

- ***Direct and Indirect Effects of No-Action Alternative A***

  No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternatives B and C***

  Direct solar radiation is the primary mechanism affecting changes in stream temperature throughout the project area. Consequently, increases in stream temperature can occur through the loss of riparian vegetation that intercepts solar radiation. Since a no-harvest buffer of 100 feet would be established between the 3 streams and the associated proposed harvest areas, stream temperatures would not likely be affected. No direct or indirect impacts to the stream-temperature component of bull trout and westslope cutthroat trout habitat would be expected beyond those described under *EXISTING CONDITIONS*.

➢ *Connectivity*

- ***Direct and Indirect Effects of All Alternatives***

  No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A***

  Cumulative impacts to bull trout and westslope cutthroat trout would not be expected.

- ***Cumulative Effects of Action Alternatives B and C***

  As described in *EXISTING CONDITIONS* and *ALTERNATIVE EFFECTS* of *Action Alternatives B and C*, the direct, indirect, and collective impacts of past- and present-related actions associated with bull trout and westslope cutthroat populations and habitat range from low to moderate. No additional future activities related to the proposed actions by location or generic type are known at this time. As described throughout the direct and indirect effects of Action Alternatives B and C, the actions would have impacts to bull trout and westslope cutthroat trout that range from negligible to net positive. Consequently, no foreseeable adverse cumulative impacts to bull trout and westslope cutthroat trout would be expected.

WILDLIFE ANALYSIS

ANALYSIS AREA

This discussion occurs at 2 scales:

The project area includes lands that DNRC manages in Sections 18, 19, 20, 21, 28, 29, 30, 31, 32, 33, and 34, T34N, R23W, and Section 13 in T34N, R24W. Full descriptions of the project area and proposed harvest units are presented in *CHAPTER II - ALTERNATIVES* (*FIGURES II-1* and *II-2*).

The second scale relates to the surrounding landscape for assessing cumulative effects. This scale varies according to the species being discussed, but generally approximates the size of the home range of the species in question.

ANALYSIS METHOD

COARSE-FILTER ASSESSMENT

DNRC recognizes that it is impossible and unnecessary to assess an affected environment or the effects of proposed actions on all wildlife species. We assume that if landscape patterns and processes similar to those that species adapted to are maintained, then the full complement of species will be maintained across the landscape (*DNRC 1996*).

Covertypes

Fire suppression probably had little effect in the project area, while past timber harvesting and diseases heavily influenced the decline in shade-intolerant tree species. The changes presumably reduce the abundance of species that use open, shade-intolerant forested habitat, while favoring species that use dense, closed-canopy habitats.

Patch Size and Interior Habitats

Species that are hesitant to cross broad expanses without forest cover, or that depend on interior-forest conditions, can be sensitive to the amount and spatial configuration of appropriate habitat.

Connectivity

The connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross broad, nonforested expanses. Key travel areas, such as saddles or near streams, are not included in the proposed harvest units.

Dead Wood

Dead wood (downed trees and snags) is an important component of the forested ecosystems. Maintenance of habitats for birds and mammals that depend on insects for food is important for long-term health of the forest. In Harvest Area III, snag densities (greater than 14 inches dbh) ranged from 0 to 16 per acre, with an average of 3.1 snags for stands in the cool and moist habitat type and 3.4 snags for stands in the cold and moderately dry habitat type. The density of snags in the other harvest areas was assessed and appears to be relatively low. This can be expected in previously harvested stands and near open roads.

FINE-FILTER ASSESSMENT

In the fine-filter analysis, individual species of concern are evaluated. These include wildlife species listed under the Endangered Species Act, species listed as sensitive by DNRC (*ARM 36.11.436(6)*), and species managed as big game by DFWP. Included are the bald eagle, Canada lynx, Rocky Mountain gray wolf, grizzly bear, fisher, pileated woodpecker, and big game.

Threatened and Endangered Species

- *Bald Eagle*

  Bald eagles nest south of Upper Whitefish Lake. No proposed units occur within the nest or primary-use areas; however, routes for log hauling intersect the nest and primary-use area. The West Fork Road, an open road, borders the

southern boundary of the nest and primary-use area, while the Whitefish Saddle Road, a restricted road, follows the primary-use area. To assess cumulative effects to bald eagles, the bald eagle territory home range was used.

- *Canada Lynx*

  Based on field reconnaissance and SLI modeling, while all proposed harvest areas occur in general or foraging habitat, denning habitat is not expected to be affected. Cumulative effects were analyzed for lands in the Upper Whitefish Grizzly Bear Subunit.

- *Gray Wolf*

  Use of the area by the gray wolf is expected to be transitory or sporadic. This project is not expected to affect gray wolves; therefore, this species was dropped from further analysis for this project.

- *Grizzly Bear*

  The project area provides year-round habitat for grizzly bears. This project could affect grizzly bears directly through increased road traffic, noise, and human activity indicated by changes in road densities. This project could affect grizzly bears indirectly by altering the amount and location of hiding cover and forage. The cumulative-effects analysis was conducted using the Upper Whitefish Grizzly Bear Subunit. Managing motorized access reduces the potential for mortality, displacement from important habitats, and habituation to humans, and provides relatively secure habitat to reduce the energetic requirements. The road-management scenario in this subunit yields an open-road density of 31.8 percent, a total-road density of 33.8 percent, and a potential security-core area of 51.6 percent.

Sensitive Species

- *Fisher*

  Fishers are generalist predators and use a variety of successional forest stages, but are most often found in stands with dense canopies. Timber harvesting and associated road construction could affect fishers by altering habitat and/or increasing their susceptibility to trapping. The Upper Whitefish Grizzly Bear Subunit was used to assess cumulative effects.

- *Pileated Woodpecker*

  Due to the relatively high elevation of the project area, the pileated woodpecker is limited to the drainage bottoms in the project area. The analysis conducted for this large project area encompassed enough area to support several pairs of pileated woodpeckers; therefore, the analysis area for cumulative effects is the project area.

Big Game Species

The big game species that inhabit the project area are deer, elk, and moose. However, due to the high elevation and heavy snow accumulations, big game use of the project area is restricted to the nonwinter period.

ALTERNATIVE EFFECTS

DIRECT EFFECTS

- ***Direct Effects of No-Action Alternative A***

  Coarse Filter: No additional displacement or disturbance of wildlife is expected in the area.

  Bald Eagle: No additional direct effects to nesting or wintering bald eagles would be expected.

  Canada Lynx: No additional activities would occur; therefore, no direct effects would be expected.

Grizzly Bears: No additional direct effects would occur under this alternative.

Fisher: No additional human disturbance or increased vulnerability to trapping would be expected.

Pileated Woodpecker: No disturbance of pileated woodpeckers would occur.

Big Game Species: No additional human disturbance or increased vulnerability to hunting would be expected.

- ***Direct Effects of Action Alternatives B and C***

Coarse Filter: Displacement and/or disturbance of wildlife species would be expected due to these alternatives. Due to the increased area and duration of Action Alternative B, Action Alternative B is expected to produce more disturbances to wildlife species than Action Alternative C. However, the features of the project design would reduce widespread disturbance of the area.

Bald Eagle: No harvesting would occur in the nest or primary-use areas. To limit disturbance to nesting eagles, Harvest Areas I and II-A would not be harvested during the eagle-nesting season (February 1 through August 15) unless the territory is determined to be unoccupied. With these mitigation measures in place, no additional disturbance effects are expected.

Canada Lynx: Some disturbance of lynx could occur in areas that have adequate cover for lynx to travel through. Lynx do not appear to avoid roads that have low traffic volumes, so increased logging traffic on open and gated roads is not expected to displace or increase the energetic cost of individual lynx. The risk of affecting lynx are higher under Action Alternative B than Action Alternative C, but both alternatives are expected to result in very minor risks of negative direct effects.

Grizzly Bears: Under these alternatives, disturbance would increase due to activities in the harvest units and on the associated access roads. To accomplish the harvests, some restricted roads would be used, but motorized use by the public would not be allowed over a period of several years. Disturbance associated with these roads are expected to result in decreased use of adjacent habitats by grizzly bears and will be discussed further in the cumulative effects analysis.

Fishers: Some displacement could occur under each action alternative; however, the effects of this displacement would be minor.

Pileated Woodpeckers: Under the action alternatives, pileated woodpeckers could be affected if harvesting occurred during the nesting period. Action Alternative C would result in a slighter risk of directly affecting pileated woodpeckers than Action Alternative B.

Big Game Species: Under each action alternative, some displacement could occur; however, the effects of this displacement would be minor.

Indirect Effects

- ***Indirect Effects of No-Action Alternatives A***

Covertypes: In the long-term, species that use the more-open stands and/or shade-intolerant tree species, would be negatively affected due to the loss of habitat. Species that use late-successional forest structure would benefit by an increase in habitat.

Patch Size and Interior and Edge Habitats: Patch size, interior habitat, and edge habitats would not change in the near term.

Dead Wood: No changes in dead wood resources would occur.

Bald Eagles: The density and proportion of shade-tolerant tree species would continue to increase in timber stands that presently provide bald eagle habitat, while growth rates in timber stands would decrease. The potential of these effects limiting nest success of this breeding pair is low.

Canada Lynx: In the short term, no effects to lynx are expected. In the longer-term without disturbance, denning habitat is expected to increase, but foraging opportunities are expected to decrease.

Grizzly Bears: No additional disturbance due to road use would occur; therefore, negligible effects are expected.

Fishers: Fisher habitat would remain relatively unchanged in the short-term.

Pileated Woodpeckers: The existing trees would continue to grow and die, thus providing potential nesting and foraging structure for pileated woodpeckers. Therefore, pileated woodpecker habitat would increase through time, then decline, resulting in a short- to mid-term moderate beneficial effect to pileated woodpeckers, but a long-term minor negative effect.

Big Game Species: No changes to big game habitat would occur in the short-term.

- ***Indirect Effects Common to Action Alternatives B and C***

Connectivity: Under both alternatives, substantial effects to connectivity are not expected; therefore, any effects are expected to be negligible.

Dead Wood: Dead-wood resources would be targeted for retention in the harvest units. Harvesting is expected to reduce the densities of small- to medium-sized snags; therefore, these alternatives are likely to affect cavity-nesting species that use snags of smaller diameter. However, retention of dominant trees, existing dead wood, and piles of cull logs is expected to provide habitat for species associated with large dead wood in the short and long terms. Action Alternative C would retain more dead-wood habitat in the project area than Action Alternative B.

Age Class: Under both action alternatives, efforts would be made to convert stands to more closely reflect the historic conditions outlined in *Losensky (1997)*. Both alternatives would benefit early-successional species at the expense of mid- to later-successional species. Action Alternative B would create more early successional habitat than Action Alternative C.

Bald Eagle: Habitat in the nest-site or primary-use areas would not be modified under these action alternatives. Therefore, the effects discussed under No-Action Alternative A are expected to occur in these areas.

Grizzly Bears: Under Action Alternatives B and C, timber harvesting would reduce hiding cover. The loss of hiding cover is expected to result in negligible, short-term (5 to 10 years) negative effects to grizzly bears. Increased forage would be about proportional to canopy

removal. The effects of both action alternatives would be minor.

Pileated Woodpeckers: Under Action Alternatives B and C, 775 acres of pileated woodpecker habitat in the project would be modified. These alternatives are expected to result in negligible negative effects to pileated woodpeckers. Species such as western larch would be planted under these alternatives and could provide habitat for pileated woodpeckers in the distant future.

Big Game Species: Removal of the overstory canopy is expected to increase forage, but would also reduce hiding cover. Since Action Alternative B would remove overstory canopy from a larger area, the effects would be more pronounced in the project area under that alternative. However, in either case, effects are expected to be negligible.

- ***Indirect Effects of Action Alternatives B***

Covertypes: On 138 acres, harvesting would promote more historic covertype representation. On the remaining 1,130 acres, the covertype would not change; however, shade-intolerant species, such as western larch and western white pine, would be planted in regeneration units to reintroduce or increase their representation in the future stand. These changes would favor wildlife species that use more open-canopy, shade-intolerant tree species at the expense of wildlife species associated with closed-canopy, shade-tolerant tree species. If whitebark pine successfully regenerates, species such as Clarke's nutcracker, grizzly bears, squirrels, etc., would benefit from an increase in key food sources.

Patch Size and Interior and Edge Habitats: Forested habitat would decrease by 1,187 acres and interior forested habitat would decrease by 1,526 acres, while edge habitat would increase by 339 acres in the Upper Whitefish Grizzly Bear Subunit. Habitat for species that use forested and interior habitat would decrease, while species that use edge and regeneration or unforested habitats would be favored.

Canada Lynx: Lynx habitat would be modified on 1,270 acres. In the short-term, available lynx habitat would decline. As stands regenerate, foraging and denning habitats are expected to increase over present.

Fishers: Under Action Alternative B, 1,270 acres of habitat would be modified. A 100-foot, no-harvest buffer along the West Fork and Stryker and Johnson creeks would be retained to protect potential high-quality resting habitat and travel corridors, since fishers travel along stream courses and prefer habitats in the proximity of water. This alternative is expected to remove fisher habitat, while retaining travel corridors along stream courses, which would result in minor negative effects to fishers.

- ***Indirect Effects of Action Alternatives C***

Covertypes: Harvesting would promote more historic covertype representation on 46 acres. On the remaining 892 acres, the covertype would not change; however, shade-intolerant species, such as western larch and western white pine, would be planted in regeneration units to reintroduce or increase their representation in the future stand. These changes would favor wildlife species that use more open-canopy, shade-intolerant tree species at the expense of wildlife species associated with closed-canopy, shade-tolerant tree species. Whitebark pine regeneration is not expected in any of these units.

Patch Size and Interior and Edge Habitats: Forested habitat would decrease by 855 acres and interior forested habitat would decrease by 1,136 acres, while edge habitat would increase by 281 acres in the Upper Whitefish Grizzly Bear Subunit.

Canada Lynx: This alternative is expected to result in the benefits discussed in Action Alternative B without the potential long-term loss of habitat on 332 acres in Harvest Area III.

Fishers: The effects discussed under Action Alternative B are expected; however, this alternative would not harvest in Harvest Area III (332 acres). Harvest Area III occurs in less desirable fisher habitat than the other areas in the flatter topography; therefore, this alternative would result in slightly less minor effects to fisher.

Cumulative Effects

- ***Cumulative Effects Common to All Alternatives***

Patch Size, Interior and Edge Habitats, and Connectivity: Adjacent USFS lands are not expected to be harvested, thereby forested habitat and patch size would be retained in those areas. The effects discussed under indirect effects would be cumulative to the conditions occurring on adjacent lands in the area.

Dead-Wood: Reductions in dead-wood resources would be cumulative to past timber and salvage harvests.

Fishers: Salvage operations and firewood cutting on State trust lands has decreased habitat. Overall, Action Alternative B would combine with other activities on Stillwater Unit to produce minor negative effects to fishers. Slightly less minor effects are expected under Action Alternative C.

Big Game Species: Since no other projects are planned in the cumulative effects area, the effects discussed for the project area also hold true for the cumulative effects area.

- ***Cumulative Effects of the No Action Alternatives A***

Covertype and Age Class: This alternative would affect wildlife species using the area by decreasing habitat diversity in the area and favoring species associated with late-succession, shade-intolerant tree species.

Bald Eagles: Under this no-action alternative, no additional disturbance or habitat modification would occur in the analysis area.

Canada Lynx: No habitat would be modified. Under this alternative, barring any disturbance, forage availability would decrease while denning habitat would increase.

Grizzly Bears: Under this alternative, motorized access to the area would remain unchanged.

Pileated Woodpeckers: Pileated woodpecker habitat in and around the project area would increase on DNRC lands through time, then decline.

- ***Cumulative Effects Common to Action Alternatives B and C***

Covertype and Age Class: Under both action alternatives, efforts would be made to convert stands to more closely reflect the historic conditions outlined in *Losensky (1997)*. These alternatives would benefit early successional species at the expense of mid- to later-successional species.

Grizzly Bear: No reasonable mitigations were identified for avoiding the short-term impacts to security core while performing the

culvert removals in Stryker basin. The Alternative Practice authorized by the Forest Management Bureau Chief would be implemented, allowing the Department to temporarily decrease the security core area below the 1996 baseline.

- ***Cumulative Effects of Action Alternatives B***

Canada Lynx: Under this alternative, 1,198 acres of lynx habitat in the Upper Whitefish Grizzly Bear Subunit would be converted to 'unsuitable' for 10 to 20 years. The conversion of habitat would be cumulative to other past harvesting on the Upper Whitefish Grizzly Bear Subunit.

Grizzly Bears: Under this alternative, grizzly bears are expected to avoid an additional 1,368 acres of habitat due to the increased motorized use on roads associated with timber harvests. Additionally, 1,052 acres of potential security would be affected.

Dependent upon which road-management scenario is selected, the proposal could exceed open-road density levels over the 1996 baseline. If the decision is made to implement year-long restrictions on either the Stryker Ridge Road or Antice Knob Road, effects to the grizzly bear are expected to be negligible. If the decision is made to implement the Alternative Practice (authorizes the Department to temporarily exceed open-road densities), grizzly bears may avoid an additional 732 acres of habitat that is currently available as a result of increased road disturbance for 2 denning seasons. This is 358 acres over the 1996 baseline level of open-road densities. Displacement of bears from quality habitats could affect grizzly bear survival and reproduction to an unknown degree. Following completion of this project, all roads would revert to current management.

- ***Cumulative Effects of Action Alternatives C***

Canada Lynx: Under this alternative, 866 acres of lynx habitat in the Upper Whitefish Grizzly Bear Subunit would be converted to 'unsuitable' for 10 to 20 years.

Grizzly Bears: Grizzly bears are expected to avoid 556 acres of habitat due to the increased motorized use on roads associated with the timber harvesting of this alternative. With the mitigation included in the project design, the amount of habitat disturbance is less then those experienced during the 1996 baseline conditions. Therefore, minor effects to bears are expected.

ECONOMIC ANALYSIS

INTRODUCTION

The proposed timber sale is located in Stillwater State Forest north of Whitefish in Flathead County. This analysis analyzes the economic impacts of the proposed timber sale project. Market activities that directly or indirectly benefit the Montana education system, generate revenue for the school trust fund, and provide funding for public buildings will be emphasized in this section. The generation of income from trust forestlands for the school trust fund and public buildings is required under the Enabling Act of 1889 and the State of Montana Constitution.

EXISTING CONDITIONS

Enrollment in Montana schools for grades kindergarten through 12 was 149,995 in fiscal year 2003. The most recent information indicates that it costs an estimated $7,080 per year to educate one student, on average. The average expenditure per pupil in Montana is below the national average.

Income from timber sales is deposited into the State's general fund. From the general fund, money is allocated through the legislative process to various educational institutions. Local school districts also raise income through property taxes. The taxable value of property is an important factor that influences the ability of a local school district to generate tax revenue.

Income from timber sales is deposited into the State's general fund to subsidize schools such as the West Valley and Bissell grade schools in Flathead County.

ALTERNATIVE EFFECTS

DIRECT EFFECTS

- ***Direct Effects of No-Action Alternative A on Economics***

  No income would be provided for schools. General fund revenues would be needed to replace money that would not be generated by one of the action alternatives.

- ***Direct Effects of Action Alternative B on Economics***

  An estimated $677,900 would be generated for the school trust fund. This revenue would be adequate to send 96 children through school for a year without other financial support.

- ***Direct Effects of Action Alternative C on Economics***

  An estimated $359,000 would be generated for the school trust fund. This revenue would be adequate to send 51 children through school for a year without other financial support.

INDIRECT EFFECTS

An indirect impact of timber sales is the employment generated and income provided to those workers who obtain jobs as a result of the timber harvest. The estimated employment in the forest industry in Montana is 10.58 jobs for every million board feet of timber harvested. The annual income associated with these jobs is $37,347 per year per job based on a weighted average of the incomes in the timber industry in Flathead and Lincoln Counties. Using this information, together with the timber harvest associated with each alternative, an estimate of the wage and salary income generated from each alternative is shown in *TABLE III-4—EMPLOYMENT AND EARNINGS IMPACT*.

TABLE III-4 - EMPLOYMENT AND EARNINGS IMPACT

ALTERNATIVE	JOBS SUPPLIED	TOTAL INCOME ($)
A	0	0
B	100	3,734,700
C	60	2,240,800

CUMULATIVE EFFECTS

This sale will be part of the annual harvest of timber from the Montana forest trust lands. The net revenue from this sale will add to this year's contribution to the trust fund. Annual contributions to the trust fund have varied widely over the years because the actual contribution to the trust is more a function of harvest than of sales.

Harvest levels can vary substantially over time; sales tend to be more consistent. Annual revenue from harvests for the last 5 years is shown in *TABLE III-5 - ANNUAL REVENUE FROM TIMBER HARVESTED FROM MONTANA TRUST LANDS*. The net contribution to the trust fund is also affected by the annual costs experienced by the Department for program management, which varies year to year. The Department should continue to make net annual contributions to the trust from its forest management program.

TABLE III-5 - ANNUAL REVENUE FROM TIMBER HARVESTED FROM MONTANA TRUST LANDS

YEAR	HARVEST REVENUE ($)
2003	8,270,589
2002	9,699,034
2001	8,524,150
2000	12,710,311
1999	6,998,847

DNRC has a State-wide sustained-yield annual harvest goal of 50 mmbf. If timber from this project is not sold, this volume could come from sales elsewhere; however, the timber may be from other areas and not benefit this region of the State. This forest area would be available for harvesting consideration again.

ROAD MANAGEMENT ASSESSMENT

INTRODUCTION

This section describes road use and road restrictions and the likely effects of the proposed actions.

METHODS

This section describes the locations, types of road restrictions, and periods of time the restrictions take effect.

ANALYSIS AREA

The Upper Whitefish Grizzly Bear Subunit is the analysis area; the project area is within this Subunit.

FIGURE III-6 - EXISTING ROADS AND ROAD MANAGEMENT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT displays both open and restricted roads within the Upper Whitefish Grizzly Bear Subunit.

TABLE III-6 - SUMMARY OF ROADS WITHIN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT INVOLVED IN THE WEST FORK TIMBER SALE PROJECT

ROADS ASSOCIATED WITH ROAD MANAGEMENT	MILES	ROAD USE	REMARKS
Upper Whitefish Road	11.3	Open for public motorized use year-round.	Access from Whitefish and Olney to the North Fork of the Flathead River.
West Fork Road	6.1		Access from Upper Whitefish Road to Stryker.
Johnson Road	3.4		This dead-end road accesses the Johnson Basin area.
Stryker Ridge Road	4.7		Accesses Stryker Ridge; the open portion of the road ends at the gate and barricade.
Antice Knob Road	5.4	Open for public motorized use July 1 through April 1.	Provides access from Stryker Ridge Road to Johnson Road.
Whitefish Saddle Road	2.4	Public motorized use is restricted April 1 through November 15.	Dead-end road. Road use beyond 1.7 miles is restricted by brush.
Stryker Basin Road	5.4		The location of these dead-end roads can be found on the alternative maps in Chapter II.
North Johnson Road	1.8		
Twin Lakes Road	1.2		
Spur IIC Roads	1.4	Due to heavy brush, motorized use is restricted.	

ALTERNATIVE EFFECTS

DIRECT EFFECTS

- ***Direct Effects of No-Action Alternative A to Road Management***

  Current access and road restriction would remain the same. Between April 1 and November 15, administrative use of restricted roads may continue at the current low level of use of 7 vehicle passes per week or more than 7 vehicle passes per week, but less use than 30 continuous days per year.

- ***Direct Effects of Road Management Common to Action Alternatives B and C***

  The Upper Whitefish and West Fork roads would remain open to public motorized use, while the North Johnson, Stryker Basin, Spur II, and Twin Lakes roads would remain restricted from public motorized use. Whitefish Saddle Road would remain restricted from public motorized use, but would be open to harvest-related activities for 1 year.

  A gate would be installed at Site A (see *ALTERNATIVE MAPS* in *CHAPTER II*) on Johnson Road to restrict public access on approximately 2.0 miles. This would be a temporary restriction for the duration of the logging activity associated with this sale. This restriction is within the project area. With this restriction in place, logging operations would be able to exceed 30 days of use on Whitefish Saddle Road and still meet the baseline open-road-density levels of 1996.

- ***Direct Effects of Action Alternative B to Road Management***

  Several road-management scenarios are proposed with Action Alternative B. With an approved Alternative Practice available to temporarily exceed open-road densities and temporarily reduce the grizzly bear security core, 1 of the 3 following scenarios may be selected by the decisionmaker to implement. The details explain where changes are proposed, their purposes, and what direct effects would occur:

  1) Scenario I would install a gate on Stryker Ridge Road near the junction of Antice Road. Approximately 4.4 miles of Stryker Ridge Road would be restricted from public motorized use from April 1 through November 15 for 2 consecutive years to allow harvesting activities to be completed in Harvest Area III.

  2) Currently, public motorized use behind gates on Antice Road is restricted on 5.4 miles of road between April 1 and June 30; the second scenario would be to lengthen the length of time to November 15 for 2 years while harvesting activities proceed in Harvest Area III.

  3) Scenario 3 would implement the Alternative Practice, which has been approved by the Acting Bureau Chief and allows DNRC to exceed the SFLM Rules for open-road density levels. No roads would have additional restrictions, except the upper portion of Johnson Road during log-hauling activities.

  The gate restriction at Site A would also remain in place during active periods of harvesting in Harvest Area III. This upper portion of the Johnson road system is narrow with steep sideslopes; therefore, restriction of public vehicles is recommended for safety purposes. When timber sale activities are completed, the gate would be removed and closures at the North Johnson and Twin Lakes roads would be reinstalled.

- ***Direct Effects of Action Alternative C to Road Management***

  In addition to roads listed under *Direct Effects to Action Alternatives B and C*, the status of the Stryker Ridge and Antice Knob roads would remain unchanged.

INDIRECT EFFECTS

- ***Indirect Effects of All Alternatives on Road Management***

  Indirect effects of the changes to public access on Stillwater State Forest may be found under *Grizzly Bears* in *APPENDIX F - WILDLIFE ANALYSIS*.

- ***Indirect Effects of Action Alternatives B and C on Road Management***

  Restricted motorized access would temporarily reduce opportunities for recreational use.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alterantive A and Action Alternative C to Road Management***

  Stillwater Unit would continue to attempt to meet the open-road density levels within the grizzly bear subunits and restrict public motorized use of roads on new or temporary roads within the subunits.

- ***Cumulative Effects of Action Alternative B to Road Management***

  Stillwater Unit would continue to attempt to meet the SFLM Rules for open-road density levels within the grizzly bear subunits and restrict public motorized use of roads on new or temporary roads within the subunits. With the implementation of Action Alternative B and the Alternative Practice for open-road densities, the open-road-density levels within the Upper Whitefish Grizzly Bear Subunit would be temporarily exceeded for approximately 2 years.

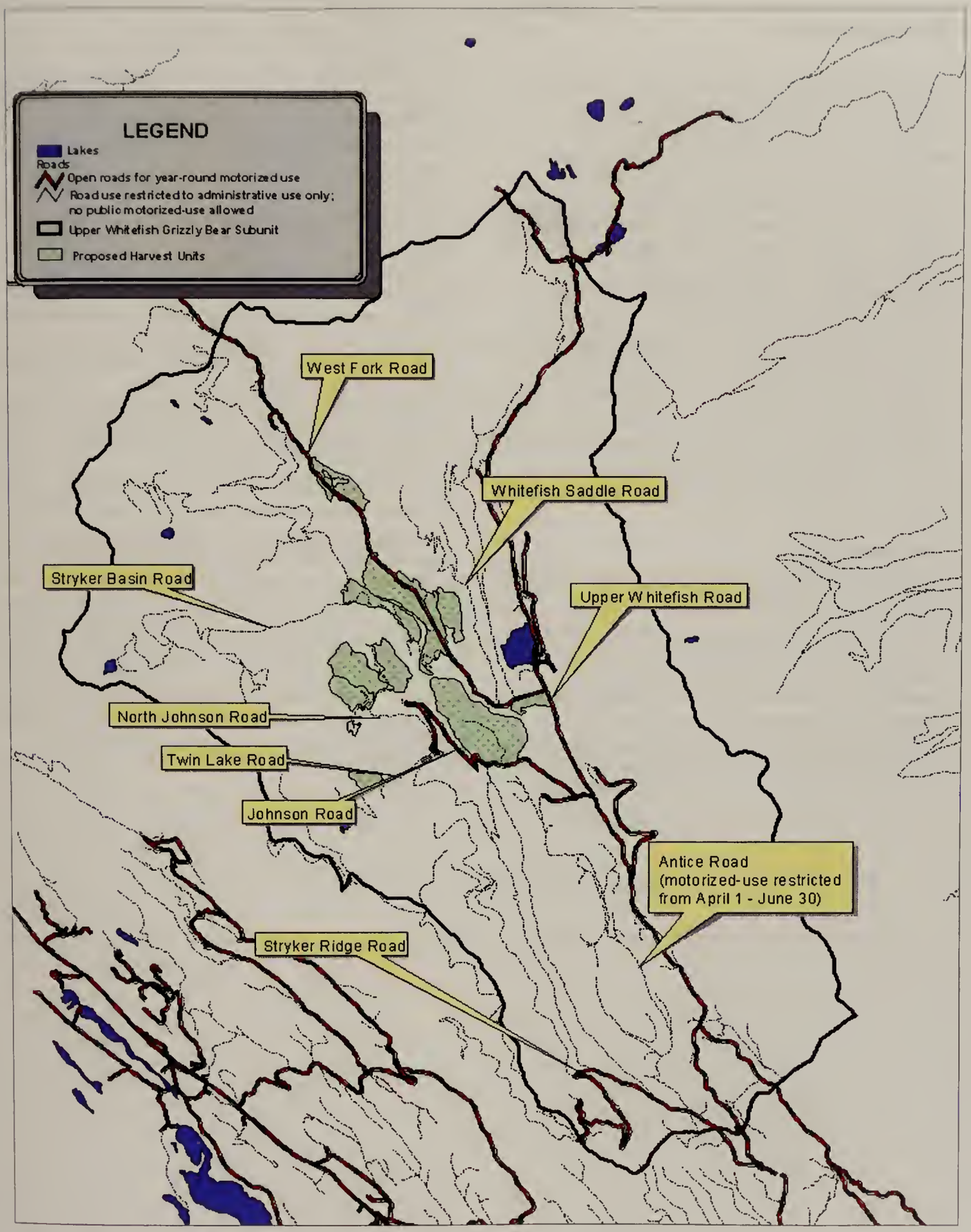


FIGURE III-6 - EXISTING ROADS AND ROAD MANAGEMENT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT

IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS OF NATURAL RESOURCES

IRRETRIEVABLE

A resource that has been irretrievably committed is lost for a period of time. Many timber stands in the project area are mature; some individual trees are more than 150 years old. Either timber-harvesting alternatives would cause live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structure and compositional diversity, aesthetics, wildlife habitat, the nutrient-recycling process, or any other important ecosystem functions.

Areas converted from timber production to permanent roads would be lost from timber production and would not function as forested lands for a period of time.

IRREVERSIBLE

An irreversible commitment of resources refers to the loss of production or use of a resource due to a land-use decision that, once executed, cannot be changed. A resource that has been irreversibly committed cannot be reversed or replaced. The initial loss of trees due to timber harvesting would not be irreversible. Natural regeneration combined with site preparation and artificial regeneration would promote the establishment of new trees. If management decisions allowed for the continued growth of established trees, they would ultimately become equivalent in size to the irretrievably harvested trees.

Timber harvesting would change plant succession, stand development, and species composition. The harvesting of old-growth timber would reduce the available old-growth habitat for an extended period of time (approximately 150 to 200 years) and would constitute an irreversible commitment of resources.

Areas that are initially lost to timber production through road construction could, over time, be reclaimed and once again produce timber and function as forested land. Temporary road construction, which is needed to access timber stands, is proposed under both action alternatives. Because these roads would be reclaimed after harvesting, only minor irreversible commitments of soil productivity would occur.

LIST OF PREPARERS

DECISIONMAKER

Bob Sandman, Unit Manager, DNRC, Stillwater State Forest, Olney, Montana 59927

ID TEAM MEMBERS

James Bower, Fisheries Program Specialist, DNRC, Missoula, MT

Paul Engelman, Economics Forester, DNRC, Missoula, MT

Michael McMahon, Co-Project Leader, DNRC, Stillwater State Forest, Olney, Montana

Norm Merz, Wildlife Biologist, DNRC, Northwestern Land Office, Kalispell, Montana

Tony Nelson, Hydrologist, DNRC, Northwestern Land Office, Kalispell, Montana

Bob Traina, Co-Project Leader, DNRC, Stillwater State Forest, Olney, Montana

Marc Vessar, Soils Scientist, DNRC, Northwestern Land Office, Kalispell, Montana

TECHNICAL SUPPORT AND ASSISTANCE

Margaret Beck, Graphics and Publication Technician, DNRC, Stillwater State Forest, Olney, Montana

Wally Bennett, Fire Management Specialist, DNRC, Northwestern Land Office, Kalispell, Montana

Dan Cassidy, Forest Improvement Specialist, DNRC, Northwestern Land Office, Kalispell, Montana

Don Copple, Fire Supervisor, DNRC, Stillwater State Forest, Olney, Montana

Pete Evans, Forest Technician, DNRC, Stillwater State Forest, Olney, Montana

Gary Hadlock, Forest Engineering Specialist, DRNC, Northwestern Land Office, Kalispell, Montana

Rick Komenda, Forest Improvement Forester, DNRC, Stillwater State Forest, Olney, Montana

Brian Manning, Forest Management Specialist, DNRC, Stillwater State Forest, Olney, Montana

GLOSSARY

Administrative road use
Road use that is restricted to DNRC personnel and contractors or for purposes such as monitoring, forest improvement, fire control, hazard reduction, etc.

Airshed
An area defined by a certain set of air conditions; typically, a mountain valley in which air movement is constrained by natural conditions such as topography.

Alevins
Juvenile fish in the developmental stage, where the egg yolk sac is still attached.

Appropriate conditions
Describes the set of forest conditions determined by DNRC to best meet the SFLMP objectives. The 4 main components useful for describing an appropriate mix of conditions are covertype proportions, age-class distributions, stand-structural characteristics, and the spatial relationships of stands (size, shape, location, etc.), all assessed across the landscape.

Bald eagle primary-use area
An area where it is assumed that 75 percent of the foraging, resting, and associated behaviors occur.

Basal area
A measure of the number of square feet of space occupied by the stem of a tree.

Bedload aggredation
Stream sediment consisting of sand, gravel, cobbles, and small boulders is termed bedload. Bedload aggredation is the accumulation of bedload sediment in a particular location.

Benthic
Bottom dwelling.

Best Management Practices (BMPs)
Guidelines to direct forest activities, such as logging and road construction, for the protection of soils and water quality.

Biodiversity
The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Board foot
144 cubic inches of wood that is equivalent to a piece of lumber 1 inch thick by 1 foot wide by 1 foot long.

Canopy
The upper level of a forest consisting of branches and leaves of the taller trees.

Canopy closure
The percentage of a given area covered by the crowns, or canopies, of trees.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Coarse down woody material
Dead trees within a forest stand that have fallen and begun decomposing on the forest floor.

Compaction
Increased soil density caused by force exerted at the soil surface, modifying aeration and nutrient availability.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Cover
See *Hiding cover* and/or *Thermal cover*.

Co-dominant tree
A tree that extends its crown into the canopy, receiving direct sunlight from above and limited sunlight on its sides. One or more sides are crowded by the crowns of other trees.

Crown cover or crown closure
The percentage of a given area covered by the crowns of trees

Cull
A tree of such poor quality that it has no merchantable value in terms of the product being cut.

Cutting units
Areas of timber proposed for harvesting.

Cumulative effect
The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor actions, but collectively they may compound the effect of the actions.

Desired future conditions
See 'Appropriate conditions'.

Direct effect
Effects on the environment that occur at the same time and place as the initial cause or action.

Ditch relief
A method of draining water from roads using ditches and corrugated metal pipe. The pipe is placed just under the surface of the road.

Dominant tree
Those trees within a forest stand that extend their crowns above surrounding trees and capture sunlight from above and around the crown.

Drain dip
A graded depression built into a road to divert water and prevent soil erosion.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Environmental effects
The impacts or effects of a project on the natural and human environment.

Equivalent clearcut acres (ECA)
This method equates the area harvested and the percent of crown removed with an equivalent amount of clearcut area.

Allowable ECA - The estimated number of acres that can be clearcut before stream channel stability is affected.

Existing ECA - The number of acres that have been previously harvested, taking into account the degree of hydrologic recovery that has occurred due to revegetation.

Remaining ECA - The calculated amount of harvesting that may occur without substantially increasing the risk of causing detrimental effects to the stability of the stream channel.

Excavator piling
The piling of logging residue using an excavator.

Fire regimes
Describes the frequency, type, and severity of wildfires. Examples include: frequent nonlethal underburns; mixed-severity fires; and stand-replacement or lethal burns.

Fledge
To rear until ready for flight or independent activity.

Forage
All browse and nonwoody plants available to wildlife for grazing.

Forest improvement
The establishment and growing of trees after a site has been harvested. Associated activities include:

- site preparation,
- planting,

- survival checks,
- regeneration surveys, and
- stand thinnings;

Fragmentation (forest)
A reduction of connectivity and an increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural character are interrupted through disturbance (stand-replacement fire, timber harvesting, etc.)

Geomorphical
A term referring to the shape of the earth or its topography.

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat type
The place or type of site where a plant or animal naturally or normally lives and grows.

Hazard reduction
The reduction of fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

HEX-RAS
A computer software package used to model stream flows.

Hiding cover
Vegetation capable of hiding some specified portion of a standing adult mammal from human view at a distance of 200 feet.

Historical forest condition
The condition of the forest prior to settlement by Europeans.

Indirect Effects
Secondary effects that occur in locations other than the initial action or significantly later in time.

Interdisciplinary team (ID Team)
A team of resource specialists brought together to analyze the effects of a project on the environment.

Intermediate trees
A characteristic of certain tree species that allows them to survive in relatively low light conditions, although they may not thrive.

Interstitial
The spaces between the rocks that make up a stream's substrate.

Introgression
The successive gene transfer/flow between hybridized individuals of a population and those individuals that are 'genetically pure' (or of some other level of genetic purity).

Landscape
An area of land with interacting ecosystems.

Macroinvertebrates
Aquatic insects.

Meter
A measurement equaling 39.37 inches.

Mitigation measure
An action or policy designed to reduce or prevent detrimental effects.

Morphology
The general shape of the stream.

Multistoried stands
Timber stands with 3 or more distinct stories.

Nest-site area (bald eagle)
The area in which human activity or development may stimulate abandonment of the breeding area, affect successful completion of the nesting cycle, or reduce productivity. This area is either mapped for a specific nest based on field data, or, if that is impossible, is defined as the area within a quarter-mile radius of all nest sites in the breeding area that have been active within 5 years.

No-action alternative
The option of maintaining the status quo and continuing present

management activities; the proposed project would not be implemented.

Nonforested area
A naturally occurring area where trees do not establish over the long term, such as bogs, natural meadows, avalanche chutes, and alpine areas.

Old growth
For this analysis, old growth is defined as stands that meet the minimum criteria (number of trees per acre that have a minimum dbh and a minimum age) for a given site (old-growth group from habitat type). These minimums can be found in the *Green et al* *Old Growth Forest Types of the Northern Region* (see *REFERENCES)*.

Overstory
The level of the forest canopy including the crowns of dominant, codominant, and intermediate trees.

Patch
A discrete area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally, but differs from what surrounds it.

Periphyton
Single-celled algae.

Permeability
The ease or rate that water passes through a layer or object.

Porosity
The quality or state of having holes through which fluid or air may pass.

Potential nesting habitat (bald eagle)
Sometimes referred to as 'suitable nesting habitat,' areas that have no history of occupancy by breeding bald eagles, but contain the potential to do so.

Project file
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the West Fork of Swift Creek Timber Sale EIS is located at the Stillwater State Forest office near Olney, Montana.

Redds
The spawning ground or nest of various fish species.

Regeneration
The replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods.

Residual stand
Trees that remain standing following any harvesting operation.

Road-construction activities
In general, the term 'road construction activities' refers to all the activities conducted while building new roads, reconstructing existing roads, and obliterating roads. Thee activities may include any or all of the following:

- road construction;
- right-of-way clearing;
- excavation of cut/fill material;
- installation of road surface and ditch drainage features;
- installation of culverts at stream crossings;
- burning right-of-way slash;
- hauling and installation of borrow material; and
- blading and shaping road surfaces.

Road improvements
Construction projects on an existing road to improve ease of travel, safety, drainage, and water quality.

Salmonids
Member of the trout family.

Saplings
Trees 1 to 4 inches in diameter at breast height.

Sawtimber trees
Trees with a minimum dbh of 9 inches.

Scarification
The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the

establishment of natural regeneration.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed and the depth of assessment that will be required. It also includes a review of other factors, such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals, the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Seedlings
Live trees less that 1 inch dbh.

Sediment
In bodies of water, solid material, mineral or organic, that is suspended and transported or deposited.

Sediment yield
The amount of sediment that is carried to streams.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade intolerant
Describes the tree species that generally can only reproduce and grow in the open or where the overstory is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In Stillwater State Forest, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, western white pine, and lodgepole pine.

Shade tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In Stillwater State Forest, shade-tolerant species generally include subalpine fir, grand fir, Engelmann spruce, and western red cedar.

Siltation
The process of very fine particles of soil (silt) settling. This may occur in streams or from runoff. An example would be the silt build-up left after a puddle evaporates.

Silviculture
The art and science of managing the establishment, composition, and growth of forests to accomplish specific objectives.

Sinuosity
A measure of meander within a stream.

Site preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation to create microclimate conditions conducive to the establishment and growth of desired species.

Slash
Branches, tree tops, and cull trees left on the ground following a harvest.

Snag
A standing dead tree or the portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

Snow intercept
The action of trees and other plants in catching falling snow and preventing it from reaching the ground.

Spur roads
Low standard roads constructed to meet minimum requirements for harvest-related traffic.

Stand
An aggregation of trees occupying a

specific area and sufficiently uniform in composition, age arrangement, and condition so as to be distinguishable from the adjoining forest.

Stand density
Number of trees per acre.

Stocking
The degree of occupancy of land by trees as measured by basal area or number of trees, and as compared to a stocking standard, which is an estimate of either the basal area or number of trees per acre required to fully use the growth potential of the land.

Stream gradient
The slope of a stream along its course, usually expressed in percentage indicating the amount of drop per 100 feet.

Stumpage
The value of standing trees in the forest; sometimes used to mean the commercial value of standing trees.

Substrate scoring
Rating of streambed particle sizes.

Succession
The natural series of replacement of one plant (and animal) community by another over time in the absence of disturbance.

Suppressed
The condition of a tree characterized by a low growth rate and low vigor due to competition.

Temporary road
Roads built to the minimal standards necessary to prevent impacts to water quality and provide a safe and efficient route to remove logs from the timber sale area. Following logging operations or site preparations, reclamation would incorporate the following concepts to discourage future motorized use of the roads:

- Segments near the beginning of the new temporary road systems would be reshaped to their natural contours and reclaimed for approximately 200 feet by grass seeding and strewing slash and debris.
- The reclamation of the remaining road would include a combination of ripping or mechanically loosening the surface soils on the road, removing culverts or bridges that were installed, spreading forest debris along portions of the road, and allowing the surface to revegetate naturally.

Territoriality
The behavioral pattern exhibited by an animal defending its territory.

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Thermal cover
For white-tailed deer, thermal cover has 70 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

For elk and mule deer, thermal cover has 50 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

Timber-harvesting activities
In general, the term timber-harvesting activities refers to all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

- felling and bucking standing trees into logs;
- skidding logs to a landing;
- processing, sorting, and loading logs onto trucks at the landing;
- hauling logs by truck to a mill;
- slashing and sanitizing residual vegetation damaged during logging;
- machine piling logging slash;
- burning logging slash;

- scarifying and preparing the site for planting; and
- planting trees.

Understory
The trees and other woody species growing under a, more or less, continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Uneven-aged stand
Various ages and sizes of trees growing together on a uniform site.

Ungulates
Hoofed animals, such as mule deer, white-tailed deer, elk, and moose, that are mostly herbivorous; many are horned or antlered.

Vigor
The degree of health and growth of a tree or stand of trees.

Watershed
The region or area drained by a river or other body of water.

Water yield
The average annual runoff for a particular watershed expressed in acre-feet.

Water-yield increase
Due to forest canopy removal, an increase in the average annual runoff over natural conditions.

Windthrow
A tree pushed over by wind. Windthrows (blowdowns) are common among shallow-rooted species and in areas where cutting or natural disturbances have reduced the density of a stand so individual trees remain unprotected from the force of the wind.

Win XSPRO
A computer software package used to model stream flows.

GLOSSARY

Administrative road use
Road use that is restricted to DNRC personnel and contractors or for purposes such as monitoring, forest improvement, fire control, hazard reduction, etc.

Airshed
An area defined by a certain set of air conditions; typically, a mountain valley in which air movement is constrained by natural conditions such as topography.

Alevins
Juvenile fish in the developmental stage, where the egg yolk sac is still attached.

Appropriate conditions
Describes the set of forest conditions determined by DNRC to best meet the SFLMP objectives. The 4 main components useful for describing an appropriate mix of conditions are covertype proportions, age-class distributions, stand-structural characteristics, and the spatial relationships of stands (size, shape, location, etc.), all assessed across the landscape.

Bald eagle primary-use area
An area where it is assumed that 75 percent of the foraging, resting, and associated behaviors occur.

Basal area
A measure of the number of square feet of space occupied by the stem of a tree.

Bedload aggredation
Stream sediment consisting of sand, gravel, cobbles, and small boulders is termed bedload. Bedload aggredation is the accumulation of bedload sediment in a particular location.

Benthic
Bottom dwelling.

Best Management Practices (BMPs)
Guidelines to direct forest activities, such as logging and road construction, for the protection of soils and water quality.

Biodiversity
The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Board foot
144 cubic inches of wood that is equivalent to a piece of lumber 1 inch thick by 1 foot wide by 1 foot long.

Canopy
The upper level of a forest consisting of branches and leaves of the taller trees.

Canopy closure
The percentage of a given area covered by the crowns, or canopies, of trees.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Coarse down woody material
Dead trees within a forest stand that have fallen and begun decomposing on the forest floor.

Compaction
Increased soil density caused by force exerted at the soil surface, modifying aeration and nutrient availability.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Cover
See *Hiding cover* and/or *Thermal cover*.

Co-dominant tree
A tree that extends its crown into the canopy, receiving direct sunlight from above and limited sunlight on its sides. One or more sides are crowded by the crowns of other trees.

Crown cover or crown closure
The percentage of a given area covered by the crowns of trees

Cull
A tree of such poor quality that it has no merchantable value in terms of the product being cut.

Cutting units
Areas of timber proposed for harvesting.

Cumulative effect
The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor actions, but collectively they may compound the effect of the actions.

Desired future conditions
See 'Appropriate conditions'.

Direct effect
Effects on the environment that occur at the same time and place as the initial cause or action.

Ditch relief
A method of draining water from roads using ditches and corrugated metal pipe. The pipe is placed just under the surface of the road.

Dominant tree
Those trees within a forest stand that extend their crowns above surrounding trees and capture sunlight from above and around the crown.

Drain dip
A graded depression built into a road to divert water and prevent soil erosion.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Environmental effects
The impacts or effects of a project on the natural and human environment.

Equivalent clearcut acres (ECA)
This method equates the area harvested and the percent of crown removed with an equivalent amount of clearcut area.

Allowable ECA - The estimated number of acres that can be clearcut before stream channel stability is affected.

Existing ECA - The number of acres that have been previously harvested, taking into account the degree of hydrologic recovery that has occurred due to revegetation.

Remaining ECA - The calculated amount of harvesting that may occur without substantially increasing the risk of causing detrimental effects to the stability of the stream channel.

Excavator piling
The piling of logging residue using an excavator.

Fire regimes
Describes the frequency, type, and severity of wildfires. Examples include: frequent nonlethal underburns; mixed-severity fires; and stand-replacement or lethal burns.

Fledge
To rear until ready for flight or independent activity.

Forage
All browse and nonwoody plants available to wildlife for grazing.

Forest improvement
The establishment and growing of trees after a site has been harvested. Associated activities include:

- site preparation,
- planting,

- survival checks,
- regeneration surveys, and
- stand thinnings;

Fragmentation (forest)
A reduction of connectivity and an increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural character are interrupted through disturbance (stand-replacement fire, timber harvesting, etc.)

Geomorphical
A term referring to the shape of the earth or its topography.

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat type
The place or type of site where a plant or animal naturally or normally lives and grows.

Hazard reduction
The reduction of fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

HEX-RAS
A computer software package used to model stream flows.

Hiding cover
Vegetation capable of hiding some specified portion of a standing adult mammal from human view at a distance of 200 feet.

Historical forest condition
The condition of the forest prior to settlement by Europeans.

Indirect Effects
Secondary effects that occur in locations other than the initial action or significantly later in time.

Interdisciplinary team (ID Team)
A team of resource specialists brought together to analyze the effects of a project on the environment.

Intermediate trees
A characteristic of certain tree species that allows them to survive in relatively low light conditions, although they may not thrive.

Interstitial
The spaces between the rocks that make up a stream's substrate.

Introgression
The successive gene transfer/flow between hybridized individuals of a population and those individuals that are 'genetically pure' (or of some other level of genetic purity).

Landscape
An area of land with interacting ecosystems.

Macroinvertebrates
Aquatic insects.

Meter
A measurement equaling 39.37 inches.

Mitigation measure
An action or policy designed to reduce or prevent detrimental effects.

Morphology
The general shape of the stream.

Multistoried stands
Timber stands with 3 or more distinct stories.

Nest-site area (bald eagle)
The area in which human activity or development may stimulate abandonment of the breeding area, affect successful completion of the nesting cycle, or reduce productivity. This area is either mapped for a specific nest based on field data, or, if that is impossible, is defined as the area within a quarter-mile radius of all nest sites in the breeding area that have been active within 5 years.

No-action alternative
The option of maintaining the status quo and continuing present

management activities; the proposed project would not be implemented.

Nonforested area
A naturally occurring area where trees do not establish over the long term, such as bogs, natural meadows, avalanche chutes, and alpine areas.

Old growth
For this analysis, old growth is defined as stands that meet the minimum criteria (number of trees per acre that have a minimum dbh and a minimum age) for a given site (old-growth group from habitat type). These minimums can be found in the *Green et al* *Old Growth Forest Types of the Northern Region* (see *REFERENCES)*.

Overstory
The level of the forest canopy including the crowns of dominant, codominant, and intermediate trees.

Patch
A discrete area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally, but differs from what surrounds it.

Periphyton
Single-celled algae.

Permeability
The ease or rate that water passes through a layer or object.

Porosity
The quality or state of having holes through which fluid or air may pass.

Potential nesting habitat (bald eagle)
Sometimes referred to as 'suitable nesting habitat,' areas that have no history of occupancy by breeding bald eagles, but contain the potential to do so.

Project file
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the West Fork of Swift Creek Timber Sale EIS is located at the Stillwater State Forest office near Olney, Montana.

Redds
The spawning ground or nest of various fish species.

Regeneration
The replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods.

Residual stand
Trees that remain standing following any harvesting operation.

Road-construction activities
In general, the term 'road construction activities' refers to all the activities conducted while building new roads, reconstructing existing roads, and obliterating roads. Thee activities may include any or all of the following:

- road construction;
- right-of-way clearing;
- excavation of cut/fill material;
- installation of road surface and ditch drainage features;
- installation of culverts at stream crossings;
- burning right-of-way slash;
- hauling and installation of borrow material; and
- blading and shaping road surfaces.

Road improvements
Construction projects on an existing road to improve ease of travel, safety, drainage, and water quality.

Salmonids
Member of the trout family.

Saplings
Trees 1 to 4 inches in diameter at breast height.

Sawtimber trees
Trees with a minimum dbh of 9 inches.

Scarification
The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the

establishment of natural regeneration.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed and the depth of assessment that will be required. It also includes a review of other factors, such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals, the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Seedlings
Live trees less that 1 inch dbh.

Sediment
In bodies of water, solid material, mineral or organic, that is suspended and transported or deposited.

Sediment yield
The amount of sediment that is carried to streams.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade intolerant
Describes the tree species that generally can only reproduce and grow in the open or where the overstory is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In Stillwater State Forest, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, western white pine, and lodgepole pine.

Shade tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In Stillwater State Forest, shade-tolerant species generally include subalpine fir, grand fir, Engelmann spruce, and western red cedar.

Siltation
The process of very fine particles of soil (silt) settling. This may occur in streams or from runoff. An example would be the silt build-up left after a puddle evaporates.

Silviculture
The art and science of managing the establishment, composition, and growth of forests to accomplish specific objectives.

Sinuosity
A measure of meander within a stream.

Site preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation to create microclimate conditions conducive to the establishment and growth of desired species.

Slash
Branches, tree tops, and cull trees left on the ground following a harvest.

Snag
A standing dead tree or the portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

Snow intercept
The action of trees and other plants in catching falling snow and preventing it from reaching the ground.

Spur roads
Low standard roads constructed to meet minimum requirements for harvest-related traffic.

Stand
An aggregation of trees occupying a

specific area and sufficiently uniform in composition, age arrangement, and condition so as to be distinguishable from the adjoining forest.

Stand density
Number of trees per acre.

Stocking
The degree of occupancy of land by trees as measured by basal area or number of trees, and as compared to a stocking standard, which is an estimate of either the basal area or number of trees per acre required to fully use the growth potential of the land.

Stream gradient
The slope of a stream along its course, usually expressed in percentage indicating the amount of drop per 100 feet.

Stumpage
The value of standing trees in the forest; sometimes used to mean the commercial value of standing trees.

Substrate scoring
Rating of streambed particle sizes.

Succession
The natural series of replacement of one plant (and animal) community by another over time in the absence of disturbance.

Suppressed
The condition of a tree characterized by a low growth rate and low vigor due to competition.

Temporary road
Roads built to the minimal standards necessary to prevent impacts to water quality and provide a safe and efficient route to remove logs from the timber sale area. Following logging operations or site preparations, reclamation would incorporate the following concepts to discourage future motorized use of the roads:

- Segments near the beginning of the new temporary road systems would be reshaped to their natural contours and reclaimed for approximately 200 feet by grass seeding and strewing slash and debris.
- The reclamation of the remaining road would include a combination of ripping or mechanically loosening the surface soils on the road, removing culverts or bridges that were installed, spreading forest debris along portions of the road, and allowing the surface to revegetate naturally.

Territoriality
The behavioral pattern exhibited by an animal defending its territory.

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Thermal cover
For white-tailed deer, thermal cover has 70 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

For elk and mule deer, thermal cover has 50 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

Timber-harvesting activities
In general, the term timber-harvesting activities refers to all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

- felling and bucking standing trees into logs;
- skidding logs to a landing;
- processing, sorting, and loading logs onto trucks at the landing;
- hauling logs by truck to a mill;
- slashing and sanitizing residual vegetation damaged during logging;
- machine piling logging slash;
- burning logging slash;

- scarifying and preparing the site for planting; and
- planting trees.

Understory
The trees and other woody species growing under a, more or less, continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Uneven-aged stand
Various ages and sizes of trees growing together on a uniform site.

Ungulates
Hoofed animals, such as mule deer, white-tailed deer, elk, and moose, that are mostly herbivorous; many are horned or antlered.

Vigor
The degree of health and growth of a tree or stand of trees.

Watershed
The region or area drained by a river or other body of water.

Water yield
The average annual runoff for a particular watershed expressed in acre-feet.

Water-yield increase
Due to forest canopy removal, an increase in the average annual runoff over natural conditions.

Windthrow
A tree pushed over by wind. Windthrows (blowdowns) are common among shallow-rooted species and in areas where cutting or natural disturbances have reduced the density of a stand so individual trees remain unprotected from the force of the wind.

Win XSPRO
A computer software package used to model stream flows.

ACRONYMS

ARM	Administrative Rules of Montana
BMP	Best Management Practices
cmp	corrugated metal pipe
CS	Common Schools (trust)
dbh	diameter at breast height
DEQ	Department of Environmental Quality
DFWP	Department of Fish, Wildlife and Parks
DNRC	Department of Natural Resources and Conservation
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
ECA	Equivalent Clearcut Acres
EIS	Environmental Impact Statement
EPA	Environmental Protection Act
FEIS	Final Environmental Impact Statement
FI	Forest Improvement
FNF	Flathead National Forest
IGBC	Interagency Grizzly Bear Committee
mbf	thousand board feet
MCA	Montana Codes Annotated
MEPA	Montana Environmental Protection Agency
mmbf	million board feet
MNHP	Montana Natural Heritage Program
NCDE	Northern Continental Divide Ecosystem
NWLO	Northwestern Land Office
RMZ	Riparian Management Zone
SFLMP	State Forest Land Management Plan
SLI	Stand Level Inventory
SMZ	Streamside Management Zone
TLMS	Trust Land Management System
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
ID Team	Interdisciplinary Team
Land Board	Montana Board of Land Commissioners
124 Permit	Stream protection Act Permit
3A Permit	Authorization A — Short-term Exemption from Montana's Surface Water-Quality Standards
SFLM Rules	State Forest Land Management Rules

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DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
STILLWATER UNIT OFFICE – STILLWATER STATE FOREST
P.O. BOX 164
OLNEY, MT 59927
(406) 881-2371

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